

2003 VIRGINIA BOWHUNTER SURVEY

by

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Abstract: Initiated in 1997, the Virginia Bowhunter Survey provides information for annually monitoring the status and relative abundance of certain wildlife species within the state. Population indices are calculated based on the number of animals observed per unit of hunting effort during the early special archery season. Surveys were mailed to 560 cooperative hunters who participated in the 2002 Virginia Bowhunter Survey. Useable responses were received from 403 hunters. Hunts were reported in all but one of the 98 counties and cities surveyed. Archery hunters participating in the survey recorded over 18,278 hours of hunting observations. A large majority (80.5%) of hunts were reported on private lands versus public lands. Frequency of hunts was similar throughout the 6-week season. Average hunt length was greatest on the first day and during the last week of the season. Annual, weekly, and regional index ratios were calculated for selected species as the number of animal observations per 100 hours of hunting effort. Cooperating hunters observed most species of animals more frequently on private lands compared to public lands. Even though only 9% of Virginia lands are publicly owned, 19.5% of all reported hunts occurred there. Cooperating hunters also reported longer hunts (4.8 hours) on public lands than on private lands (4.2 hours). Graphs illustrating animal observations per 100 hours hunting effort reported from 1997 through 2003 are presented. Time-series analyses suggest that ruffed grouse populations have decreased and coyote populations have increased since 1997 when the survey was initiated. Continued effort is needed to increase cooperator participation and improve the geographic distribution of survey respondents.

The 2003 Virginia Bowhunter Survey is a cooperative effort by volunteer sportsmen and the Department of Game and Inland Fisheries (DGIF) to annually monitor the status and relative abundance of wildlife resources within the state. This annual survey of early season archery hunter observations was established in 1997 to provide harvest independent data for evaluating the status of certain wildlife species. Observations of wildlife per unit of bowhunting effort provides a useful index of annual population abundance for these species.

Monitoring wildlife populations with archery hunter observation data is a technique also used

in several other eastern and midwestern states (Lehman and Weaver 1998, Dwyer 1997, Glasscock et al. 1997, Hamilton and Fantz 1997, Ver Steeg and Warner 1997). These surveys have proven successful in detecting annual population changes and have advantages that include broad coverage, cost-effectiveness, and simplicity.

Public participation in archery hunting has been relatively stable during recent years and continues to be popular across all regions of Virginia (Rodgers et al. 2003). The early archery season generally occurs from the first Saturday in October through the Friday proceeding the

firearms deer season and provides sportsmen with an opportunity to observe animals with relatively little disturbance. Virginia archery license sales totaled 58,476 resident hunters and 2,927 non-resident hunters during the 2003-2004 hunting season. Rodgers et al. (2003) estimated that 55,365 bowhunters spent approximately 501,995 days afield during the 2001-2002 deer archery season.

The bowhunter survey also provides a means for validating other techniques used for monitoring certain wildlife species (Lehman and Weaver 1998). In general, population indices derived from chance observations of wildlife per unit of effort (e.g., bowhunter surveys) provide more accurate assessments of population abundance than those derived from harvest data. For example, furbearer indices derived from fur-buyer surveys or pelt tagging data are known to be biased because harvest efforts are influenced by annual variations in pelt prices (Obbard et al. 1987).

Unfortunately, harvest independent surveys used for monitoring furbearer populations, such as scent station surveys (Hamilton et al. 1990), mark-recapture studies (Otis et al. 1978), road mortality indices (Clark and Andrews 1981), and aerial surveys (Sargeant et al. 1975) are expensive and often problematic. Difficulties using these methods have led Virginia and other states to adopt bowhunter surveys as a preferred method for assessing the status of some fur-bearing species (Hamilton et al. 1990, Ver Steeg and Warner 1997).

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Methods

Survey forms (Appendix 1 and 2) were mailed immediately following the 2003 early archery season (mid-October). Normally, survey forms were mailed 1 week prior to the opening of the season (late September). Personnel shortages

resulted in the survey being distributed late during 2003. Survey forms were mailed to 560 archery hunters who participated in the 2002 Virginia Bowhunter Survey and several other individuals who expressed interest in participating.

The survey form provided an opportunity for hunters to record incidental observations of wildlife species, domestic animals of management interest, and other hunters during hunts in the early archery season (4 October through 14 November 2003). For each date hunted, a cooperator was asked to record the county, hours hunted, whether the land hunted was privately or publicly owned, and three weather parameters (Appendix 1). Data were analyzed statewide, east and west of the Blue Ridge Mountains, by geographic region (Figure 1), by week of the survey period, by land ownership, and by land ownership east and west of the Blue Ridge Mountains. The Tidewater, Southern Piedmont, and Northern Piedmont regions were considered "east of the Blue Ridge Mountains", while the Southern Mountain and Northern Mountain regions were considered "west of the Blue Ridge Mountains". Daily records were excluded if "county" or "hours hunted" were not specified.

Doe-buck ratios were calculated by dividing number of doe deer observed by the number of antlered deer observed; fawn-doe ratios were calculated by dividing the number of deer fawn seen by the number of doe deer seen.

Standard errors (SE) for all observations expressed per unit of time (i.e., 100 hours) were calculated using ratio-estimators (Cochran 1977).

Results

Participation and Hunter Effort

A total of 403 early archery hunters returned survey forms by 31 January 2004. The 403 cooperating archery hunters reported 4,233 total hunts averaging 4.3 hours per hunt (Table 1) for a total of 18,278 hours of observation. Hunts were reported in all but 1 of the 98 counties or cities (no hunts were reported in Newport News/Hampton). The counties of Alleghany,

Buchanan, Frederick, Greene, Lunenburg, Mathews, and Warren had fewer than 10 hunts reported (Appendix 3). Shenandoah County had the highest number of reported hunts ($n = 201$) and accounted for 4.8% of all hunts reported.

The number of reported hunts was greater east ($n = 2,838$) than west ($n = 1,395$) of the Blue Ridge Mountains, although average hunt length was slightly greater west (4.5 hours) than east (4.2 hours; Table 1). A large majority (80.5%) of reported hunts were on private lands. Even though only 9% of Virginia lands are publicly owned, 19.5% of all reported hunts occurred there. Cooperating hunters also reported longer hunts (4.8 hours) on public lands than on private lands (4.2 hours; Table 2). West of the Blue Ridge Mountains, the proportion of cooperators who reported hunts on public land (38.0%) was greater than the proportion of hunters reporting hunts on public lands east of the Blue Ridge Mountains (19.2%; Table 2).

The average number of hunts reported by archers varied by geographic region (Figure 1). Hunters in the South Mountain region were the most avid, averaging 10.4 hunts per hunter. The average number of hunts was similar in the South Piedmont ($\bar{x} = 9.1$), Tidewater ($\bar{x} = 8.8$), and North Piedmont ($\bar{x} = 8.6$) regions. The lowest number of hunts reported per archer was in the North Mountain region ($\bar{x} = 7.5$). The average number of hunts per hunter was similar east of the Blue Ridge Mountains ($\bar{x} = 9.8$) and west of the Blue Ridge Mountains ($\bar{x} = 9.5$). Cooperating archery hunters reported slightly longer hunts (# hours/hunt) in the North Mountain ($\bar{x} = 4.5$), South Mountain ($\bar{x} = 4.5$), and North Piedmont ($\bar{x} = 4.4$) regions, versus the Tidewater ($\bar{x} = 4.2$) and South Piedmont ($\bar{x} = 4.1$) regions (Table 3).

The average number of hunts per week per hunter was similar throughout the six-week season (2.3 to 2.9 hunts). Average hunt length (# hours/hunt) was highest on the first day ($\bar{x} = 5.2$) and last week ($\bar{x} = 4.8$) of the early archery season (Table 4).

Selected Animal Observations

Animal observation data reported by

cooperating hunters during the 2003 early archery season are summarized for selected species in Tables 1 – 6. In addition, the observational data of selected species per 100 hours hunting effort reported in surveys conducted from 1997 through 2003 (Lafon et al. 1998, 2004; Farrar et al. 1999, 2000, 2001, 2002) are presented in Figures 2 – 35. While all tables are referenced in the text, some figures are not specifically mentioned.

East vs. West of Blue Ridge Mountains – Cooperators observed more antlered bucks, gray squirrels, red and gray foxes, raccoons, and domestic dogs per hour of hunting east versus west of the Blue Ridge Mountains (Table 1). Deer does, fawns, fox squirrels, wild turkeys, ruffed grouse, black bears, coyotes, bobcats, skunks and hunters were observed more frequently per hour of hunting west of the Blue Ridge Mountains. Observation rates of opossums, river otters, mink, and house cats were similar east and west of the Blue Ridge Mountains.

Private vs. Public Land – Most wildlife species, domestic dogs, and house cats were observed more frequently on private lands than on public lands (Tables 1 and 2). Exceptions were ruffed grouse, bear (west of the Blue Ridge Mountains), and coyotes (east of the Blue Ridge Mountains). More than twice as many hunters were seen on public lands than on private lands both east and west of the Blue Ridge Mountains.

Physiographic Regions – Observations of selected animal species by cooperating archery hunters varied by geographic region (Table 3). Archery hunters in the mountain regions reported more observations of deer fawns and deer of unknown age/sex than in other regions. Observations of fox squirrels and ruffed grouse were also greater in the mountain regions. Black bear observation rates were highest in the North Mountains and lowest in the Tidewater region. Red foxes were observed much more frequently in the Northern Piedmont, whereas gray foxes were observed most frequently in the Tidewater region. Observation rates for coyotes were higher in the Southern Mountains than in any other region. The statewide population of

coyotes appears to have increased from 1997 to 2001, then stabilized during 2002 to 2003 (Figure 22). Bobcats were observed most frequently in the Southern Mountain region.

Observation rates for wild turkeys were highest in the Southern Mountains and lowest in the North Piedmont region. Ruffed grouse were seen most often in the Southern Mountains than in any other region. Raccoon observation rates were highest in the Tidewater and Northern Piedmont regions and lowest in the Northern Mountains. Observation rates for dogs were highest in the Tidewater region and lowest in the Northern Mountains. Other hunters were seen most often in the North Piedmont and South Mountain regions.

Weeks - Frequency of animal observations by week of the season is summarized in Table 4. Antlered deer were observed most frequently toward the end of the early archery season, close to the rut. Observation rates of does were similar throughout the season. Wild turkey observations were also similar throughout the season, peaking during week 5. Observation rates of black bears decreased dramatically as the archery season progressed. The highest observation rate for bears was during week 1, prior to the time when bears could be legally harvested. Gray squirrel observations peaked during the middle of the season then declined. Observation rates for most other species appeared to fluctuate throughout the season without an apparent pattern. More hunters were encountered on opening day and the first week than during other portions of the season.

Deer - Doe to antlered buck ratios estimated from survey data were higher west of the Blue Ridge Mountains than east (Table 5a). Public lands had a higher doe to buck ratio than private lands (Table 6b). The Northern Mountain region reported the highest ratio of does to antlered bucks; the Tidewater region reported the lowest doe to antlered buck ratio (Table 6c). The doe to buck ratio peaked during the middle of the season (week 3), then decreased as bucks became more active with the approaching rut (Table 6d).

Domestic dogs and cats -- Dogs, house cats, and

furbearers constitute a majority of potential mammalian predators in Virginia. The combined statewide observations of dogs and cats ($n = 530$) represented 35.5% of all mammalian predators observed. The combined dog and cat observations east and west of the Blue Ridge Mountains comprised 36.1% and 34.2% of the total number of mammalian predators observed, respectively. Combined dog and cat observations on private and public lands represented 35.9% and 33.0% of total mammalian predators observed, respectively.

Other Species Observations

Bowhunters were asked to record incidental observations of miscellaneous species ("other animals") not specifically listed on the survey sheet. (Appendix 1). Thirty different "other animals" were reported (Table 6). Hawks, chipmunks, groundhogs, and rabbits were some of the incidental species most commonly observed. Caution should be used when interpreting data summarized in Table 6 because some hunters may have chosen to report animals that others would not report. Despite the potential issue of accuracy of these data, we have no reason to question the precision of these estimates and therefore consider them useful as trend indicators for some species.

Discussion and Summary

Observational data reported in surveys from 1997 through 2003 has proven useful for monitoring populations of certain wildlife species. Although population information derived from a 7-year period is generally not sufficient to detect long-term changes, some trends are becoming apparent. Time-series data illustrated in Figures 2 through 35 suggests that ruffed grouse are decreasing (Figure 14) and coyotes are increasing (Figure 22). Populations of most other species seem to fluctuate annually, but are relatively stable over the long-term. Information collected from successive bowhunter surveys should provide sufficient time-series data for performing detailed trend

analyses in the future.

The high variability associated with some observation estimates suggests that the survey may not be adequate for monitoring population trends for certain animals. High variability may be a consequence of small sample size (e.g., only 6 mink were seen) or a non-uniform sampling distribution (poor regional estimates). Annual and weekly variability can also be attributed to abiotic (e.g., weather) and biotic influences (e.g., breeding seasons and mast availability). Annual fluctuations in food availability and timing of the breeding season affect animal activity and movement patterns.

Despite these potential problems, bowhunter surveys still provide useful information for the more observable species and for those whose populations are difficult to monitor using any other method. In addition, doe-buck and fawn-doe ratios may help identify regions with productivity problems and areas that provide greater opportunities to harvest quality bucks. More detailed analyses of animal observation data in relation to weather conditions and mast availability may also help explain annual fluctuations in hunter success.

For this survey to achieve its full potential, continued effort is needed to improve the sample size and distribution of survey respondents. Additional bowhunter cooperators can be recruited by sending an invitation letter to a stratified sample of hunters who purchased an early archery license. By stratifying the sample to target areas with poor cooperation, a more uniform distribution of survey respondents can be developed and the opportunity for regional bias can be minimized.

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Table 1. Observations of selected animals (per 100 hours hunting) by cooperating archery hunters 4 October to 14 November 2003 statewide, east (EBR) and west (WBR) of the Blue Ridge Mountains, and on private and public lands in Virginia.

Animal	Total Seen	<u>Animals Seen/100 hrs. \pm SE</u>				
		State	EBR	WBR	Private Land	Public Land
Deer (antlered)	2,183	11.94 \pm 0.62	13.06 \pm 0.80	9.82 \pm 0.89	13.80 \pm 0.72	5.90 \pm 0.79
Deer (doe)	5,427	29.69 \pm 1.39	28.64 \pm 1.73	31.68 \pm 2.29	32.11 \pm 1.59	22.47 \pm 2.42
Deer (fawn)	2,294	12.55 \pm 0.91	11.07 \pm 1.00	15.37 \pm 1.80	13.89 \pm 1.01	8.18 \pm 1.91
Deer (unknown)	1,800	9.85 \pm 0.56	9.18 \pm 0.68	11.12 \pm 0.95	10.98 \pm 6.53	6.28 \pm 8.32
Gray Squirrel	19,533	106.86 \pm 4.61	118.43 \pm 5.25	84.86 \pm 8.61	111.48 \pm 4.62	89.34 \pm 13.02
Fox Squirrel	1,024	5.60 \pm 0.88	0.83 \pm 0.22	14.69 \pm 2.20	5.65 \pm 0.83	5.68 \pm 2.79
Wild Turkey	4,471	24.46 \pm 2.36	19.48 \pm 1.86	33.94 \pm 5.74	27.05 \pm 2.88	16.47 \pm 3.53
Grouse	187	1.02 \pm 0.18	0.16 \pm 0.08	2.67 \pm 0.44	0.86 \pm 0.20	1.62 \pm 0.34
Bear	124	0.68 \pm 0.15	0.43 \pm 0.15	1.14 \pm 0.31	0.62 \pm 0.15	0.94 \pm 0.43
Red Fox	196	1.07 \pm 0.17	1.21 \pm 0.24	0.81 \pm 0.22	1.29 \pm 0.22	0.25 \pm 0.10
Gray Fox	171	0.94 \pm 0.12	1.15 \pm 0.16	0.52 \pm 0.16	1.05 \pm 0.15	0.61 \pm 0.20
Coyote	62	0.34 \pm 0.08	0.23 \pm 0.08	0.54 \pm 0.16	0.33 \pm 0.08	0.41 \pm 0.20
Bobcat	50	0.27 \pm 0.06	0.21 \pm 0.06	0.40 \pm 0.13	0.25 \pm 0.06	0.28 \pm 0.10
Raccoon	392	2.14 \pm 0.20	2.42 \pm 0.27	1.62 \pm 0.25	2.28 \pm 0.22	1.72 \pm 0.43
Opossum	48	0.26 \pm 0.05	0.25 \pm 0.05	0.28 \pm 0.10	0.29 \pm 0.05	0.20 \pm 0.11
Striped Skunk	37	0.20 \pm 0.05	0.16 \pm 0.05	0.29 \pm 0.10	0.25 \pm 0.06	0.05 \pm 0.04
River Otter	15	0.08 \pm 0.04	0.08 \pm 0.05	0.08 \pm 0.06	0.09 \pm 0.04	0.05 \pm 0.05
Mink	6	0.03 \pm 0.01	0.03 \pm 0.02	0.03 \pm 0.02	0.04 \pm 0.02	0.03 \pm 0.03
Dog	424	2.32 \pm 0.25	2.64 \pm 0.33	1.72 \pm 0.38	2.53 \pm 0.29	1.55 \pm 0.52
House Cat	106	0.58 \pm 0.08	0.56 \pm 0.10	0.62 \pm 0.14	0.70 \pm 0.10	0.20 \pm 0.09
Hunter	1,244	6.81 \pm 0.82	6.37 \pm 0.98	7.64 \pm 1.37	5.15 \pm 0.71	11.60 \pm 2.36
Total Hunters		403	290	147	348	129
Total Hunts		4,233	2,838	1,395	3,370	815
Avg. Hrs. Per Hunt		4.32 \pm 0.04	4.22 \pm 0.05	4.51 \pm 0.06	4.16 \pm 0.04	4.84 \pm 0.09

Table 2. Observations (per 100 hours of hunting) of selected animals by cooperating archery hunters 4 October to 14 November 2003 on private and public lands east (EBR) and west (WBR) of the Blue Ridge Mountains in Virginia.

Animal	<u>Animals Seen/100 hrs. \pm SE</u>			
	EBR		WBR	
	Private Land	Public Land	Private Land	Public Land
Deer (antlered)	14.29 \pm 0.88	7.36 \pm 1.25	12.59 \pm 1.17	4.77 \pm 1.04
Deer (doe)	30.43 \pm 1.92	21.10 \pm 3.37	36.21 \pm 2.80	23.54 \pm 3.42
Deer (fawn)	12.24 \pm 1.13	4.93 \pm 1.14	17.92 \pm 2.07	10.71 \pm 3.20
Deer (unknown)	10.13 \pm 0.76	4.64 \pm 0.90	13.06 \pm 1.24	7.56 \pm 1.23
Gray Squirrel	121.55 \pm 5.79	99.66 \pm 11.32	86.78 \pm 6.22	81.32 \pm 21.55
Fox Squirrel	0.91 \pm 0.26	0.23 \pm 0.23	17.28 \pm 2.29	9.90 \pm 4.74
Wild Turkey	21.87 \pm 2.17	7.31 \pm 1.58	39.75 \pm 8.19	23.58 \pm 5.84
Grouse	0.14 \pm 0.10	0.23 \pm 0.14	2.64 \pm 0.59	2.70 \pm 0.55
Bear	0.49 \pm 0.18	0.17 \pm 0.10	0.94 \pm 0.26	1.53 \pm 0.72
Red Fox	1.39 \pm 0.28	0.16 \pm 0.08	1.06 \pm 0.33	0.36 \pm 0.16
Gray Fox	1.22 \pm 0.19	0.99 \pm 0.38	0.64 \pm 0.22	0.32 \pm 0.17
Coyote	0.22 \pm 0.09	0.35 \pm 0.25	0.59 \pm 0.15	0.45 \pm 0.30
Bobcat	0.18 \pm 0.05	0.17 \pm 0.12	0.41 \pm 0.17	0.36 \pm 0.16
Raccoon	2.44 \pm 0.28	2.49 \pm 0.87	1.90 \pm 0.34	1.13 \pm 0.36
Opossum	0.28 \pm 0.06	0.12 \pm 0.08	0.30 \pm 0.10	0.27 \pm 0.19
Striped Skunk	0.18 \pm 0.06	0.06 \pm 0.06	0.42 \pm 0.16	0.05 \pm 0.04
River Otter	0.10 \pm 0.06	0.00 \pm 0.00	0.07 \pm 0.17	0.09 \pm 0.09
Mink	0.03 \pm 0.02	0.06 \pm 0.06	0.05 \pm 0.03	0.00 \pm 0.00
Dog	2.82 \pm 0.35	1.80 \pm 1.00	1.82 \pm 0.45	1.35 \pm 0.52
House Cat	0.60 \pm 0.11	0.41 \pm 0.19	0.94 \pm 0.21	0.05 \pm 0.04
Hunter	5.16 \pm 0.90	10.67 \pm 3.28	5.10 \pm 0.92	12.33 \pm 3.17
Total Hunters (<i>n</i>)	253	60	119	73

Table 3. Observations (per 100 hours of hunting) of selected animals by cooperating archery hunters 4 October to 14 November 2003 within geographic regions of Virginia.

Animal	<u>Animals Seen/ 100 hrs. \pm SE</u>				
	Tidewater	S. Piedmont	N. Piedmont	S. Mountain	N. Mountain
Deer (antlered)	13.70 \pm 1.14	10.11 \pm 0.95	15.08 \pm 1.97	10.58 \pm 1.13	8.39 \pm 1.39
Deer (doe)	27.93 \pm 2.67	25.50 \pm 2.06	32.82 \pm 4.04	33.02 \pm 3.02	29.20 \pm 3.34
Deer (fawn)	10.71 \pm 1.14	11.09 \pm 2.11	11.57 \pm 2.19	16.79 \pm 2.50	12.74 \pm 2.13
Deer (unknown)	9.36 \pm 0.99	8.90 \pm 1.07	9.20 \pm 1.51	10.73 \pm 1.16	11.83 \pm 1.61
Gray Squirrel	89.77 \pm 7.29	136.29 \pm 8.00	142.35 \pm 10.90	72.77 \pm 6.20	107.28 \pm 20.57
Fox Squirrel	0.34 \pm 0.23	0.69 \pm 0.30	1.67 \pm 0.61	12.15 \pm 1.96	19.41 \pm 4.85
Wild Turkey	20.11 \pm 2.48	27.81 \pm 4.60	10.24 \pm 1.83	45.61 \pm 8.36	12.29 \pm 2.80
Grouse	0.20 \pm 0.16	0.09 \pm 0.06	0.17 \pm 0.15	3.13 \pm 0.63	1.81 \pm 0.42
Bear	0.06 \pm 0.06	0.20 \pm 0.08	1.21 \pm 0.49	0.61 \pm 0.18	2.13 \pm 0.75
Red Fox	0.73 \pm 0.16	0.32 \pm 0.12	2.80 \pm 0.74	0.49 \pm 0.15	1.41 \pm 0.57
Gray Fox	1.76 \pm 0.28	0.43 \pm 0.13	0.98 \pm 0.35	0.49 \pm 0.18	0.59 \pm 0.29
Coyote	0.06 \pm 0.04	0.46 \pm 0.23	0.26 \pm 0.15	0.78 \pm 0.24	0.09 \pm 0.09
Bobcat	0.18 \pm 0.08	0.17 \pm 0.08	0.29 \pm 0.15	0.51 \pm 0.18	0.18 \pm 0.09
Raccoon	2.83 \pm 0.42	1.82 \pm 0.41	2.42 \pm 0.57	1.69 \pm 0.31	1.49 \pm 0.43
Opossum	0.28 \pm 0.08	0.29 \pm 0.13	0.17 \pm 0.08	0.34 \pm 0.13	0.18 \pm 0.09
Striped Skunk	0.22 \pm 0.10	0.12 \pm 0.07	0.12 \pm 0.08	0.29 \pm 0.14	0.27 \pm 0.15
River Otter	0.18 \pm 0.11	0.03 \pm 0.03	0.00 \pm 0.00	0.12 \pm 0.09	0.00 \pm 0.00
Mink	0.04 \pm 0.03	0.00 \pm 0.00	0.06 \pm 0.04	0.02 \pm 0.02	0.05 \pm 0.04
Dog	3.27 \pm 0.60	2.60 \pm 0.53	1.76 \pm 0.47	2.37 \pm 0.56	0.50 \pm 0.20
House Cat	0.57 \pm 0.16	0.49 \pm 0.15	0.61 \pm 0.19	0.68 \pm 0.19	0.50 \pm 0.18
Hunter	5.76 \pm 1.52	4.56 \pm 1.06	9.06 \pm 2.24	8.80 \pm 1.90	5.49 \pm 1.49
Total Hunters	138	92	92	87	65
Total Hunts	1,215	836	787	907	488
Avg. Hrs. Per Hunt	4.16 \pm 0.06	4.14 \pm 0.09	4.41 \pm 0.09	4.51 \pm 0.08	4.52 \pm 0.11

Table 4. Observations (per 100 hours of hunting) of selected animals by cooperating archery hunters by week from 4 October to 14 November 2003 in Virginia.

Animal	<u>Animals Seen/100 hrs. + SE</u>						
	Day 1 (10/4)	Week 1 (10/6-11)	Week 2 (10/13-18)	Week 3 (10/20-25)	Week 4 (10/27-11/1)	Week 5 (11/3-8)	Week 6 (11/10-14)
Deer (antlered)	10.87 ± 1.21	9.00 ± 0.89	11.14 ± 0.92	10.00 ± 0.84	12.74 ± 1.14	14.60 ± 1.13	16.80 ± 1.58
Deer (doe)	28.71 ± 2.55	26.25 ± 2.03	29.71 ± 2.33	32.71 ± 2.41	29.15 ± 2.26	29.20 ± 2.17	31.77 ± 2.72
Deer (fawn)	14.69 ± 1.73	13.56 ± 1.49	12.61 ± 1.34	11.46 ± 1.28	11.02 ± 1.28	12.92 ± 1.39	12.80 ± 2.00
Deer (unknown)	6.15 ± 1.13	6.88 ± 0.79	8.22 ± 0.86	10.70 ± 1.08	10.94 ± 1.06	13.40 ± 1.57	11.79 ± 1.52
Gray Squirrel	92.56 ± 5.73	98.63 ± 6.05	115.71 ± 6.38	117.22 ± 7.57	110.50 ± 6.83	101.50 ± 6.03	99.68 ± 7.80
Fox Squirrel	3.15 ± 0.85	4.63 ± 1.24	6.62 ± 1.54	5.30 ± 1.13	6.81 ± 1.19	5.80 ± 1.25	5.63 ± 1.53
Wild Turkey	19.94 ± 4.02	23.84 ± 3.20	25.59 ± 3.16	23.54 ± 3.17	25.17 ± 3.96	26.25 ± 4.26	24.74 ± 5.96
Grouse	0.37 ± 0.20	0.81 ± 0.19	1.26 ± 0.43	0.91 ± 0.22	0.99 ± 0.26	1.42 ± 0.41	1.06 ± 0.46
Bear	0.82 ± 0.37	1.07 ± 0.42	0.87 ± 0.25	0.79 ± 0.24	0.42 ± 0.19	0.41 ± 0.17	0.19 ± 0.09
Red Fox	0.97 ± 0.35	0.60 ± 0.15	1.05 ± 0.29	1.07 ± 0.21	1.45 ± 0.35	1.24 ± 0.32	1.16 ± 0.34
Gray Fox	0.97 ± 0.31	1.04 ± 0.23	1.08 ± 0.25	0.85 ± 0.20	0.88 ± 0.25	1.01 ± 0.24	0.63 ± 0.19
Coyote	0.15 ± 0.15	0.40 ± 0.15	0.27 ± 0.14	0.37 ± 0.13	0.42 ± 0.20	0.45 ± 0.17	0.19 ± 0.12
Bobcat	0.22 ± 0.13	0.17 ± 0.07	0.21 ± 0.13	0.18 ± 0.09	0.50 ± 0.18	0.37 ± 0.24	0.29 ± 0.12

Table 4 (continued). Observations (per 100 hours of hunting) of selected animals by cooperating archery hunters by week from 4 October to 14 November 2003 in Virginia.

Animal	<u>Animals Seen/100 hrs. + SE</u>						
	Day 1 (10/4)	Week 1 (10/6-11)	Week 2 (10/13-18)	Week 3 (10/20-25)	Week 4 (10/27-11/1)	Week 5 (11/3-8)	Week 6 (11/10-14)
Raccoon	1.87 ± 0.48	2.62 ± 0.54	2.56 ± 0.43	2.80 ± 0.50	1.80 ± 0.38	1.35 ± 0.27	1.40 ± 0.32
Opossum	0.00 ± 0.00	0.23 ± 0.10	0.24 ± 0.09	0.40 ± 0.12	0.08 ± 0.05	0.45 ± 0.16	0.29 ± 0.13
Striped Skunk	0.07 ± 0.07	0.13 ± 0.07	0.21 ± 0.11	0.27 ± 0.11	0.23 ± 0.09	0.26 ± 0.10	0.14 ± 0.08
River Otter	0.00 ± 0.00	0.00 ± 0.00	0.06 ± 0.04	0.25 ± 0.16	0.08 ± 0.08	0.08 ± 0.08	0.05 ± 0.05
Mink	0.15 ± 0.11	0.00 ± 0.00	0.03 ± 0.03	0.00 ± 0.00	0.00 ± 0.00	0.04 ± 0.04	0.10 ± 0.07
Dog	2.32 ± 0.57	1.71 ± 0.45	1.93 ± 0.41	2.01 ± 0.39	3.94 ± 0.72	2.66 ± 0.58	1.83 ± 0.42
House Cat	0.45 ± 0.18	0.47 ± 0.14	0.60 ± 0.14	0.67 ± 0.16	0.61 ± 0.20	0.56 ± 0.17	0.63 ± 0.18
Hunter	8.92 ± 1.24	7.65 ± 1.39	7.28 ± 1.42	4.73 ± 0.08	6.81 ± 1.34	7.23 ± 1.13	6.21 ± 1.12
Total Hunters	242	291	321	303	280	211	168
Total Hunts	255	702	762	816	649	612	437
Avg. Hrs. Per Hunt	5.23 ± 0.15	4.24 ± 0.08	4.36 ± 0.09	4.02 ± 0.07	4.03 ± 0.09	4.36 ± 0.10	4.75 ± 0.13

Table 5. Doe-buck and fawn-doe ratio estimates (a) east and west of the Blue Ridge Mountains, (b) by land ownership, (c) by region, and (d) by week of survey season based on cooperating archery hunter observations in Virginia from 4 October to 14 November 2003.

(a)

Ratio	Statewide	East of BR	West of BR
Doe: Buck	2.49	2.19	3.23
Fawn: Doe	0.42	0.39	0.49

(b)

Ratio	Private	Public
Doe: Buck	2.33	3.81
Fawn: Doe	0.43	0.36

(c)

Ratio	Tidewater	S. Piedmont	N. Piedmont	S. Mountain	N. Mountain
Doe: Buck	2.04	2.52	2.18	3.12	3.48
Fawn: Doe	0.38	0.43	0.35	0.51	0.44

(d)

Ratio	Day 1	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Doe: Buck	2.64	2.92	2.67	3.27	2.29	2.00	1.89
Fawn: Doe	0.51	0.52	0.42	0.35	0.38	0.44	0.40

Table 6. Statewide total observations and total observations per 100 hunts of miscellaneous animals by cooperating archery hunters 4 October to 14 November 2003 in Virginia.

Animal	Total Observations	Observations / 100 Hunts
Bats	2	0.05
Beaver	8	0.19
Buzzard	3	0.07
Chipmunk	63	1.49
Crow	21	0.50
Doves	0	0.00
Ducks	18	0.43
Eagle	20	0.47
Falcon	2	0.05
Flying Squirrels	1	0.02
Geese	23	0.54
Groundhog	59	1.39
Hawk	72	1.70
Hérons	2	0.05
Miscellaneous Birds	32	0.76
Mouse	1	0.02
Muskrat	0	0.00
Nutria	0	0.00
Owl	25	0.59
Pheasant	0	0.00
Quail	11	0.26
Rabbit	47	1.11
Red Squirrel	1	0.02
Shrew	0	0.00
Sika & Other Deer	2	0.05
Snake	5	0.12
Snipe	0	0.00
Turtles	5	0.12
Weasel	0	0.00
Woodcock	12	0.28

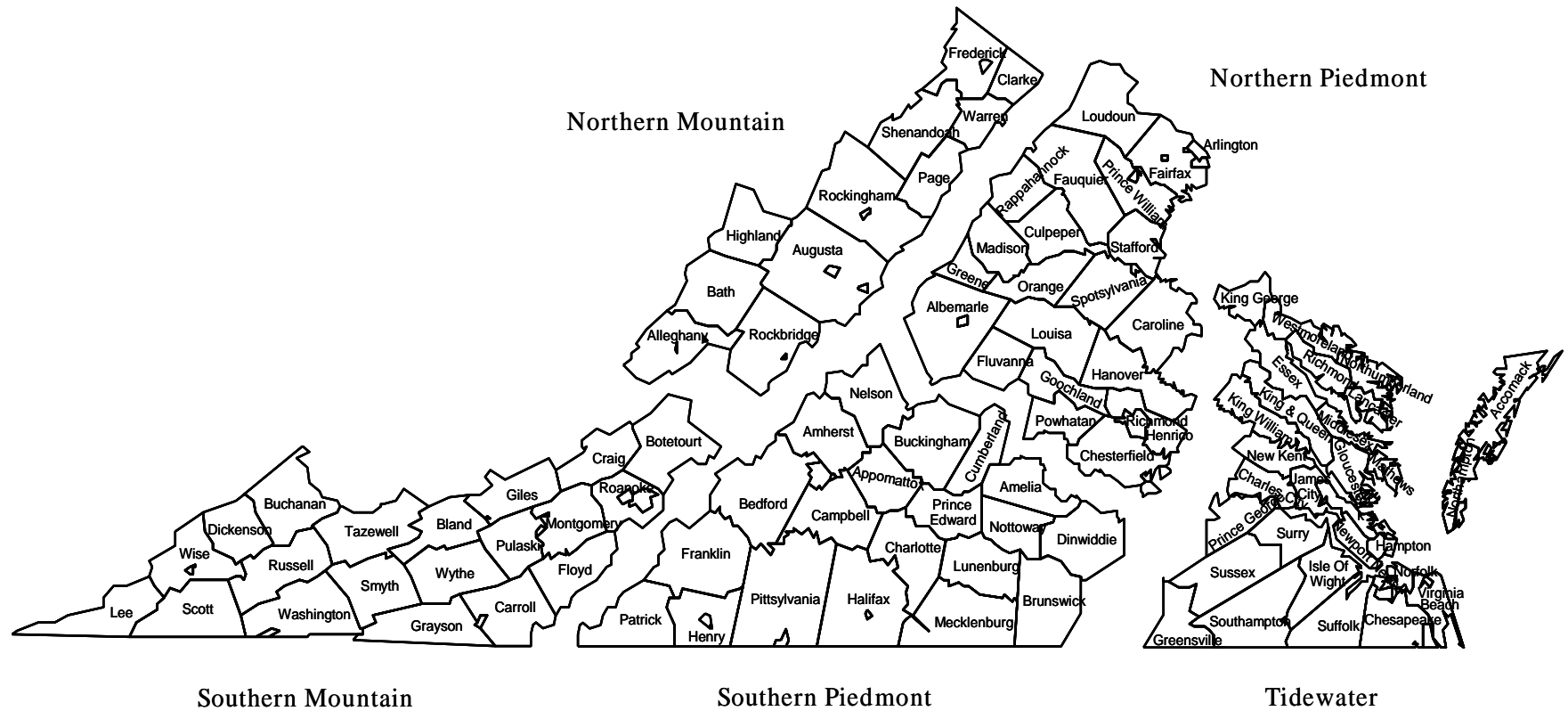


Figure 1. Geographic regions of Virginia used for analyses in this report.

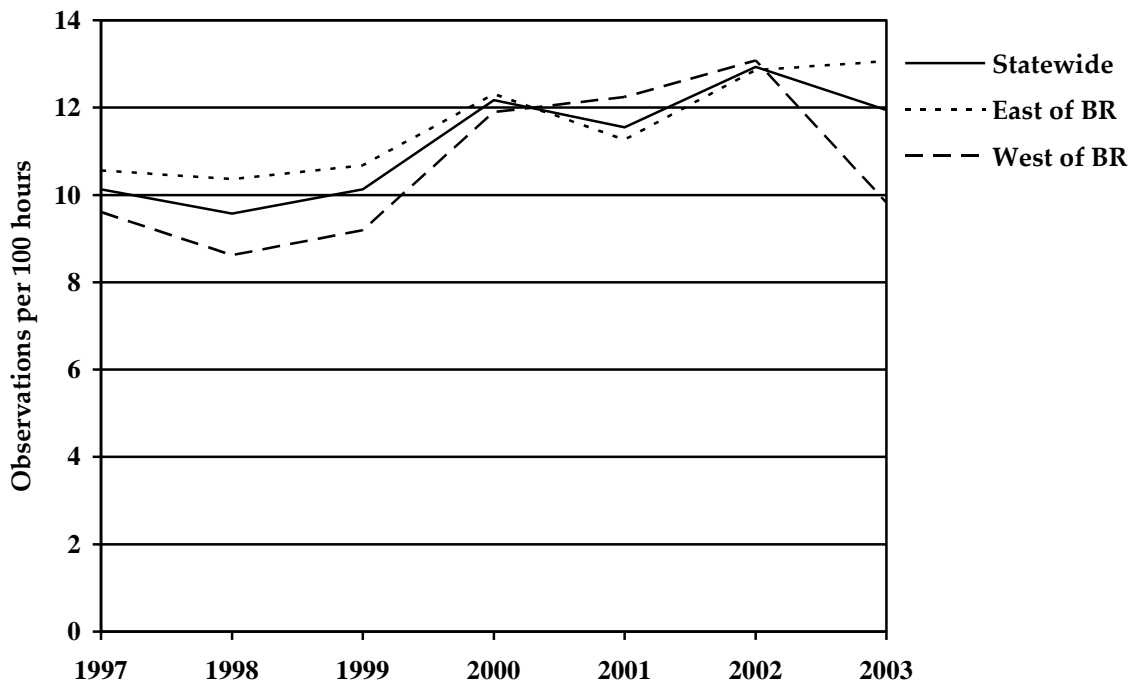


Figure 2. Antlered deer observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

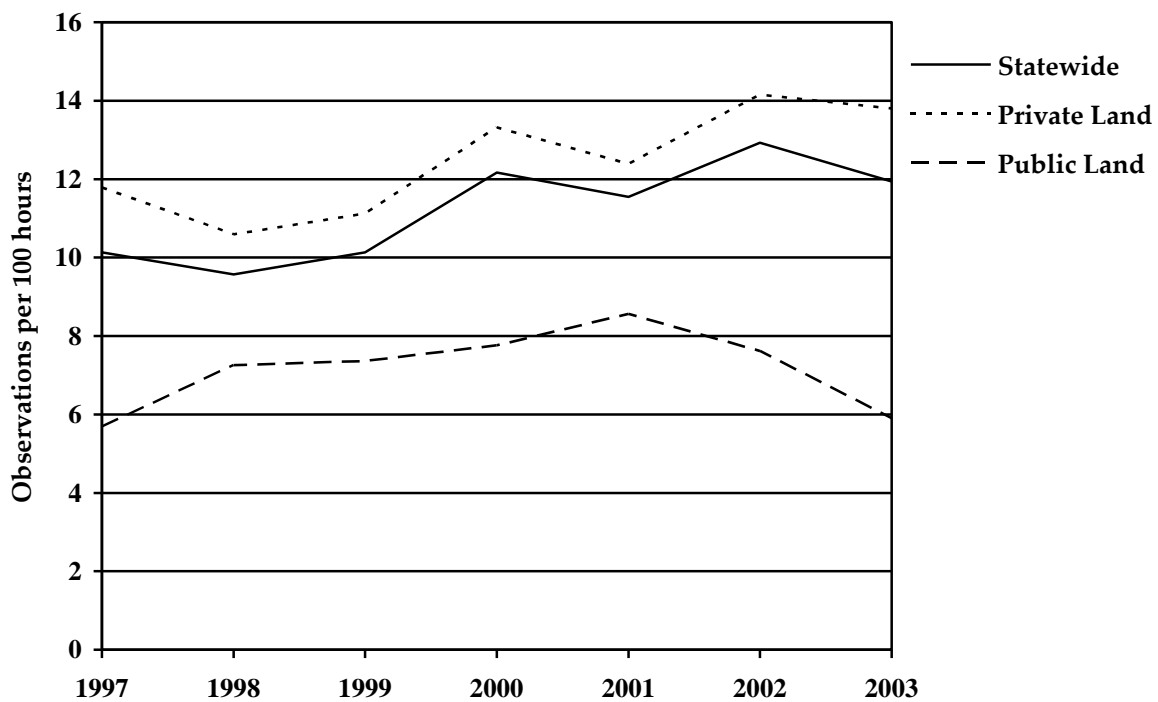


Figure 3. Antlered deer observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

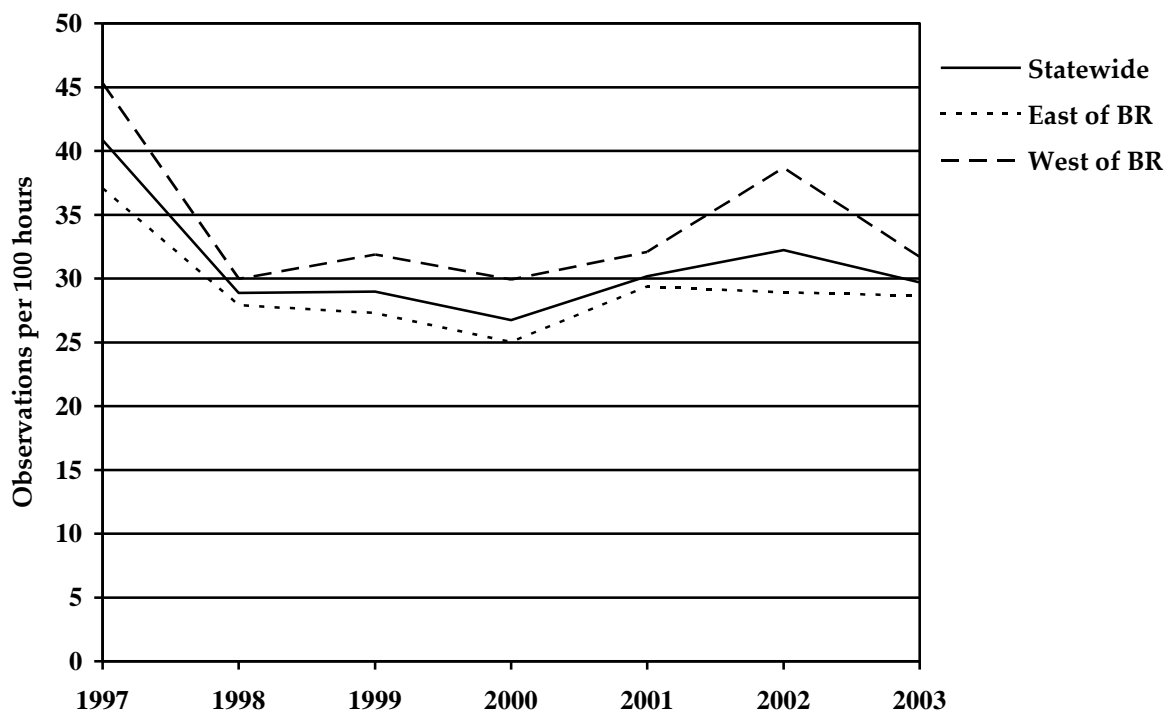


Figure 4. Doe deer observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

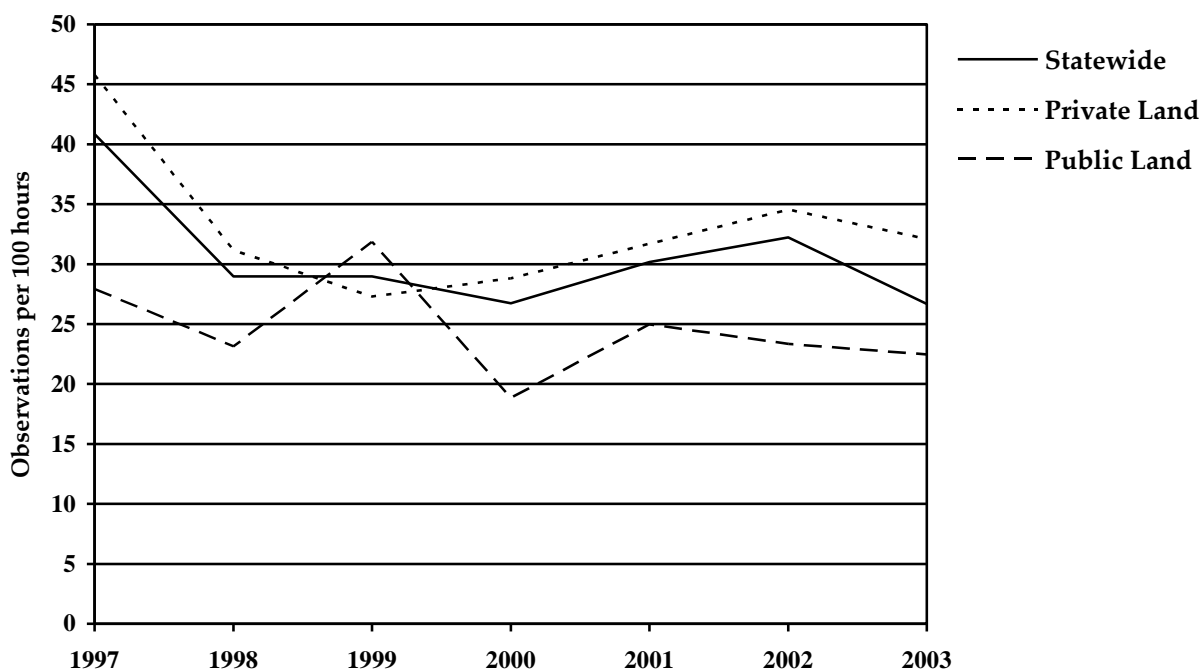


Figure 5. Doe deer observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

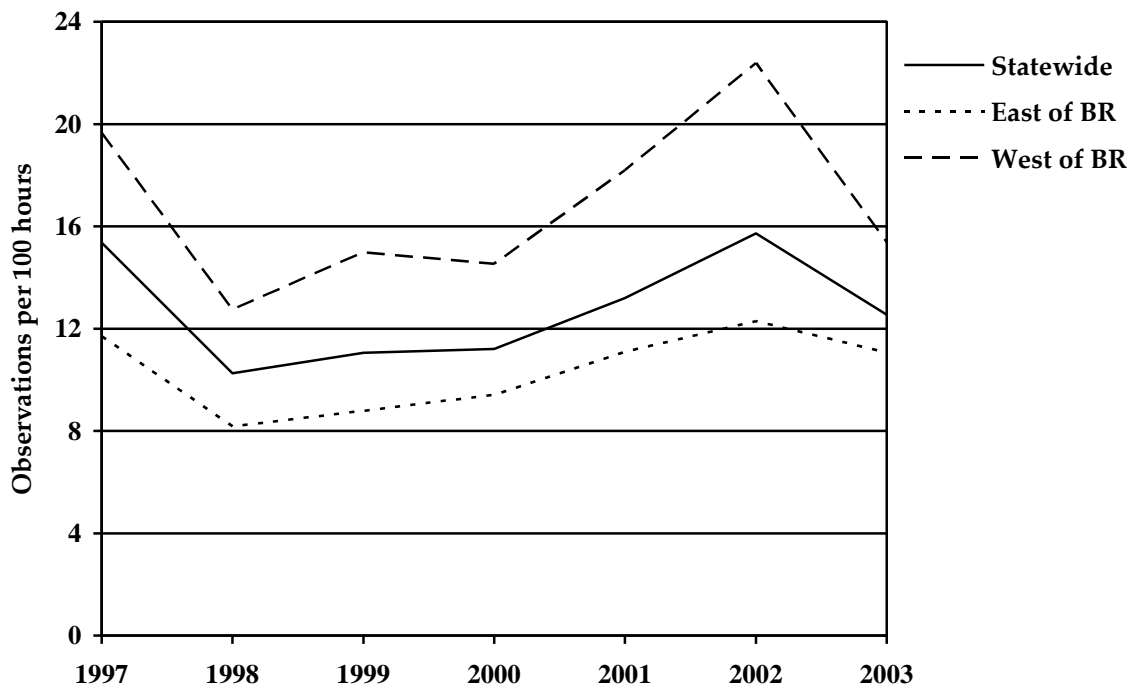


Figure 6. Fawns observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

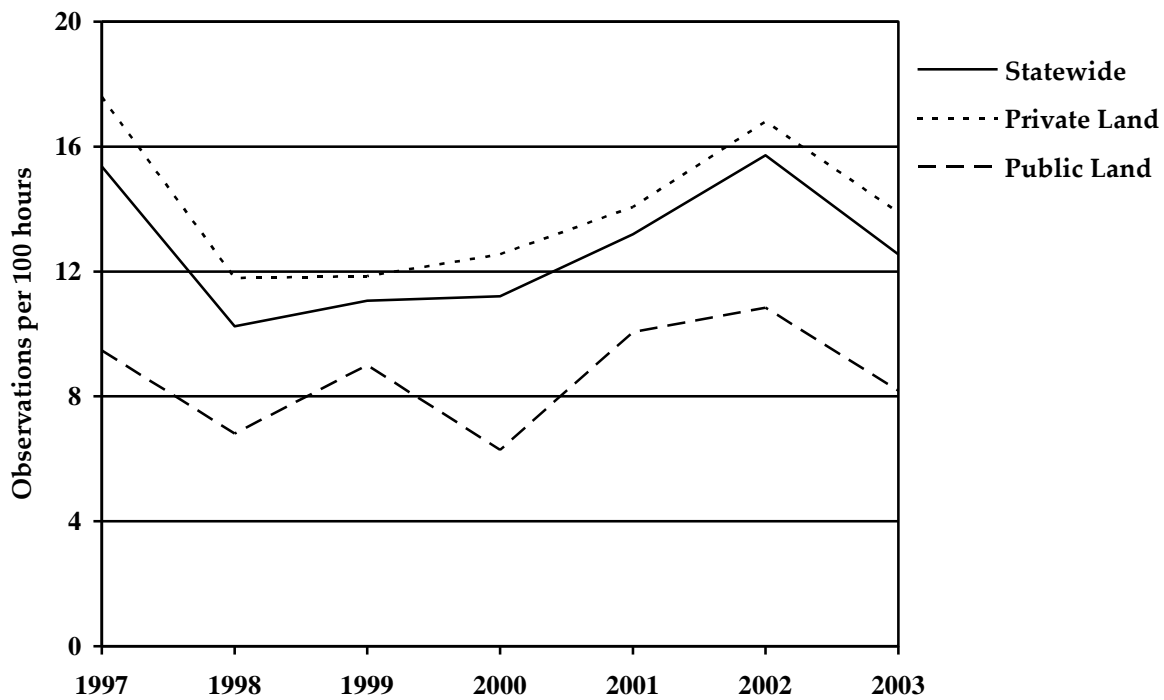


Figure 7. Fawns observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

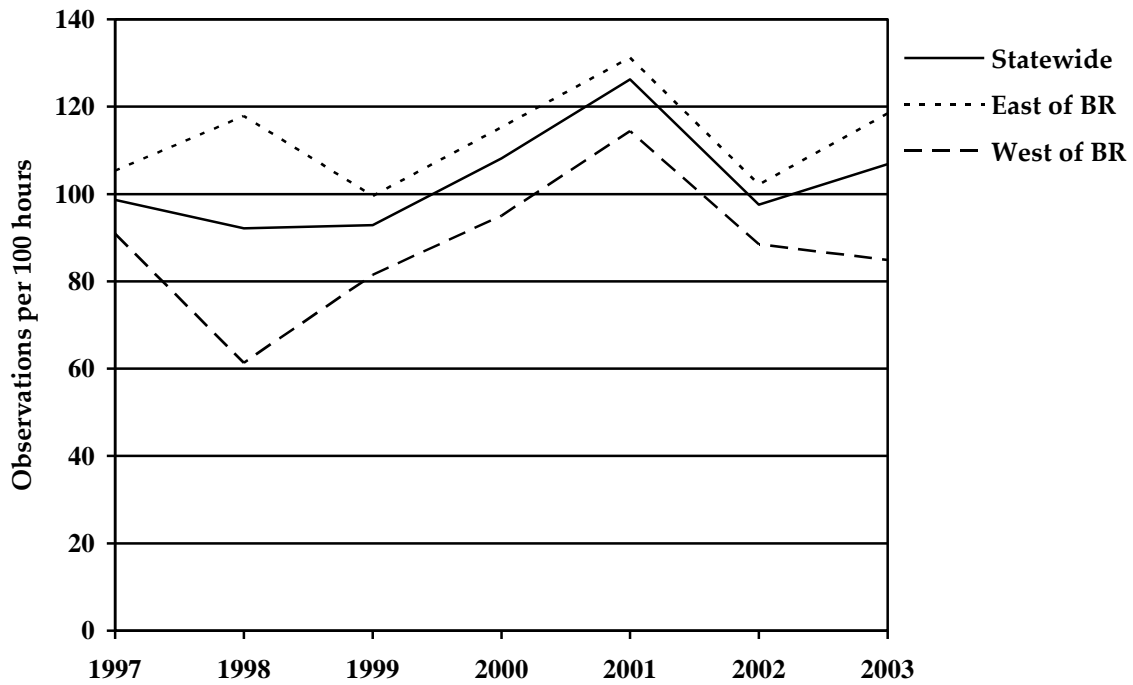


Figure 8. Gray squirrels observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

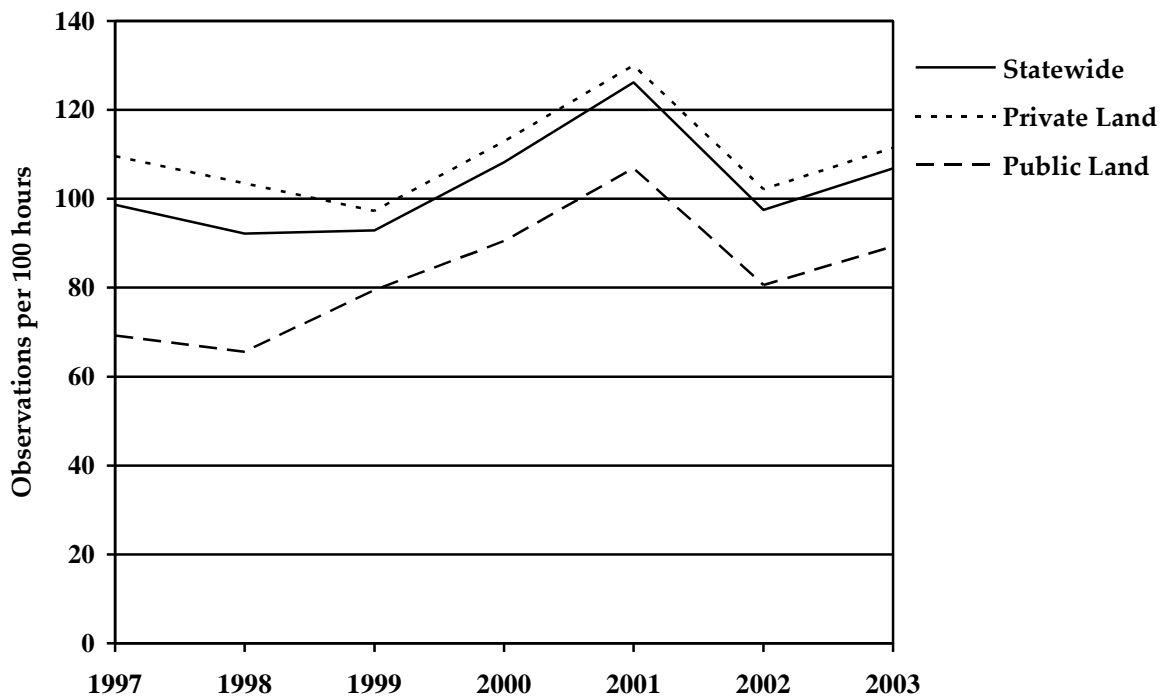


Figure 9. Gray squirrels observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

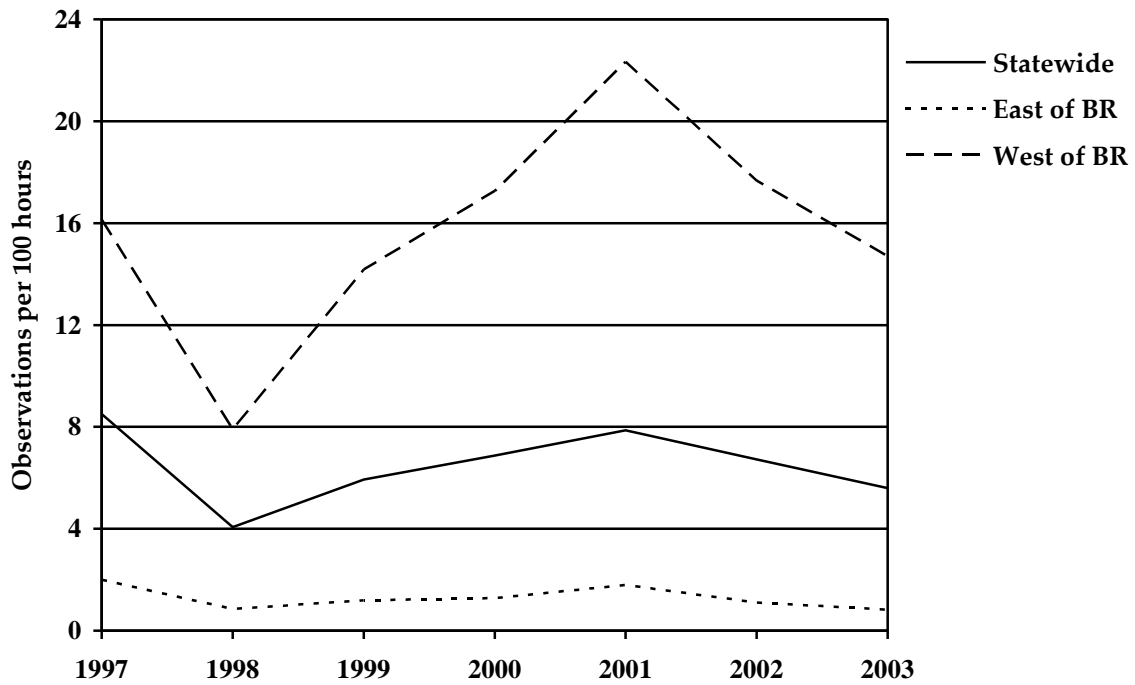


Figure 10. Fox squirrels observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

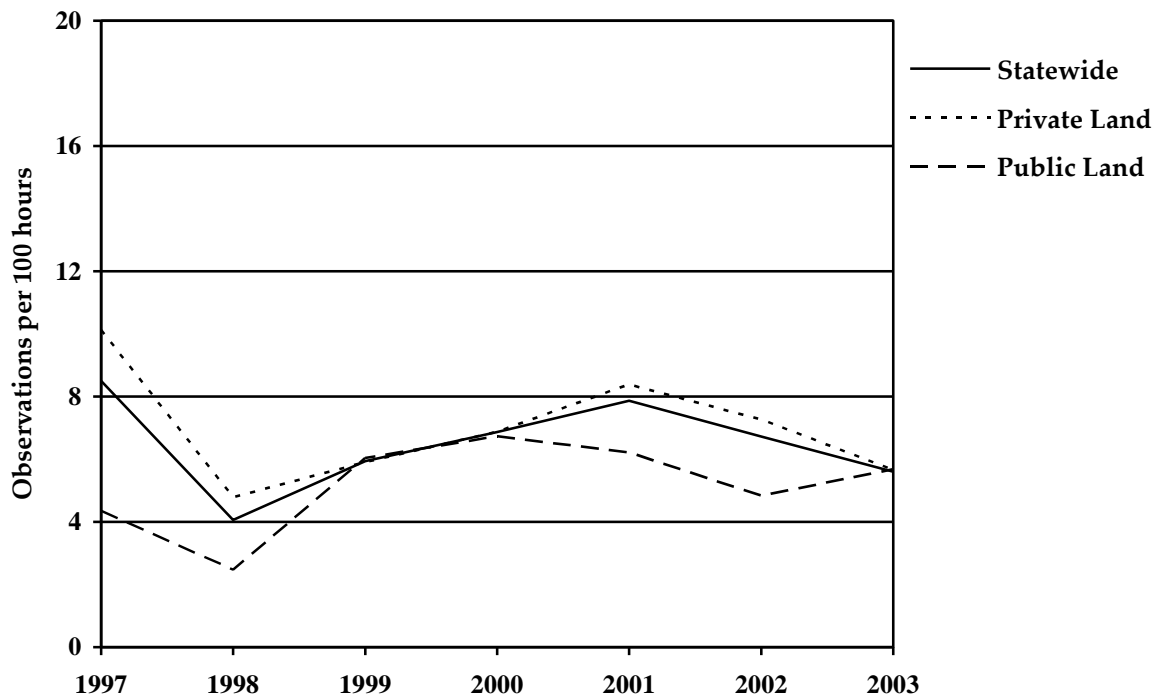


Figure 11. Fox squirrels observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

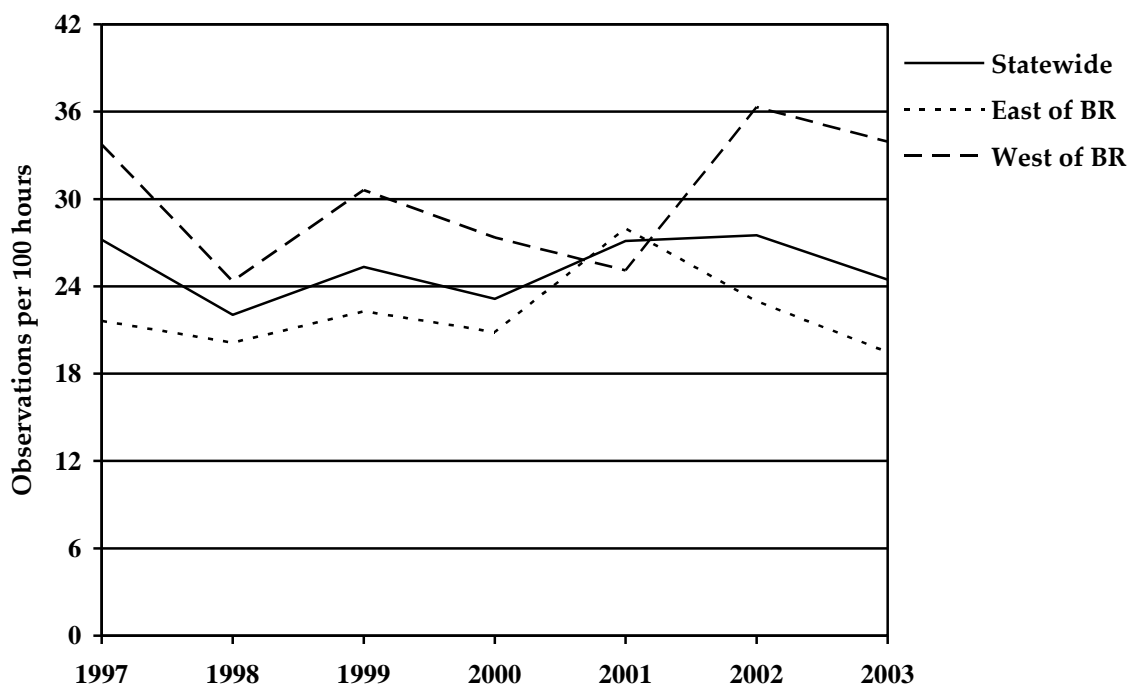


Figure 12. Wild turkeys observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

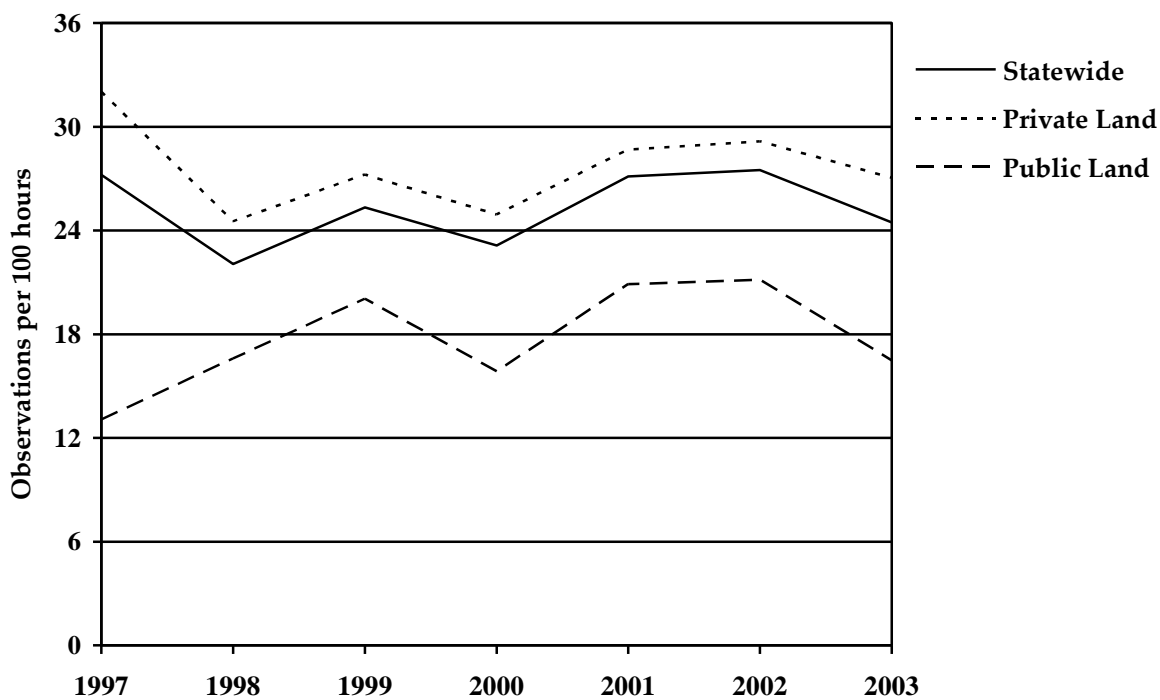


Figure 13. Wild turkeys observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

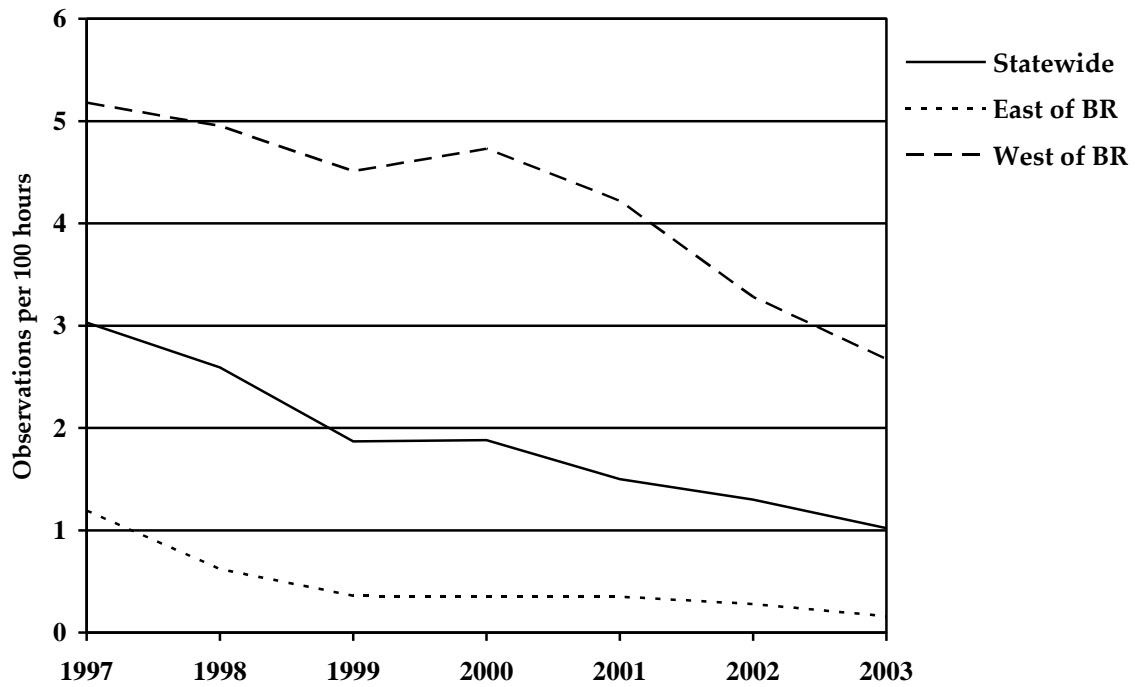


Figure 14. Ruffed grouse observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

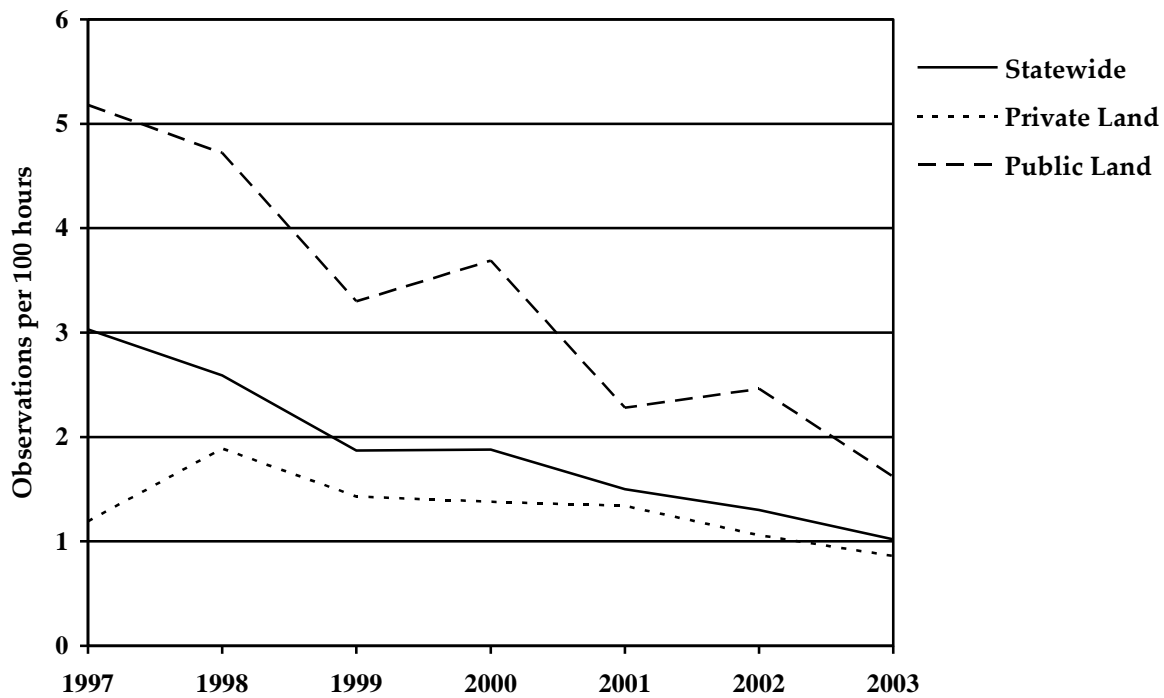


Figure 15. Ruffed grouse observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

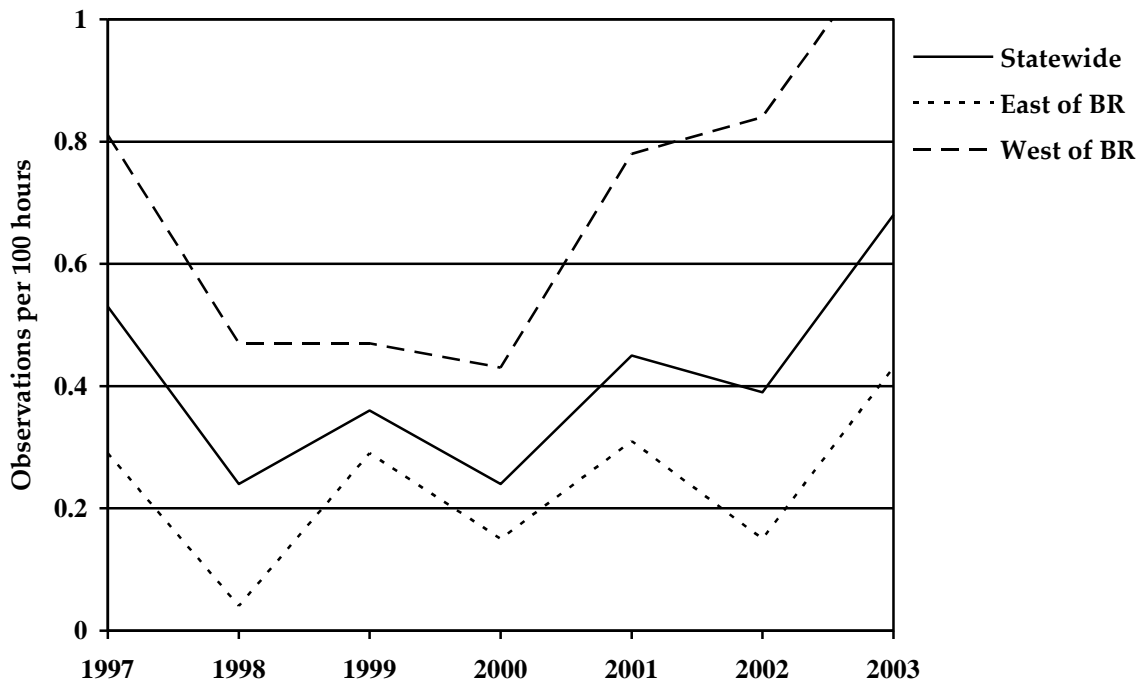


Figure 16. Black bears observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

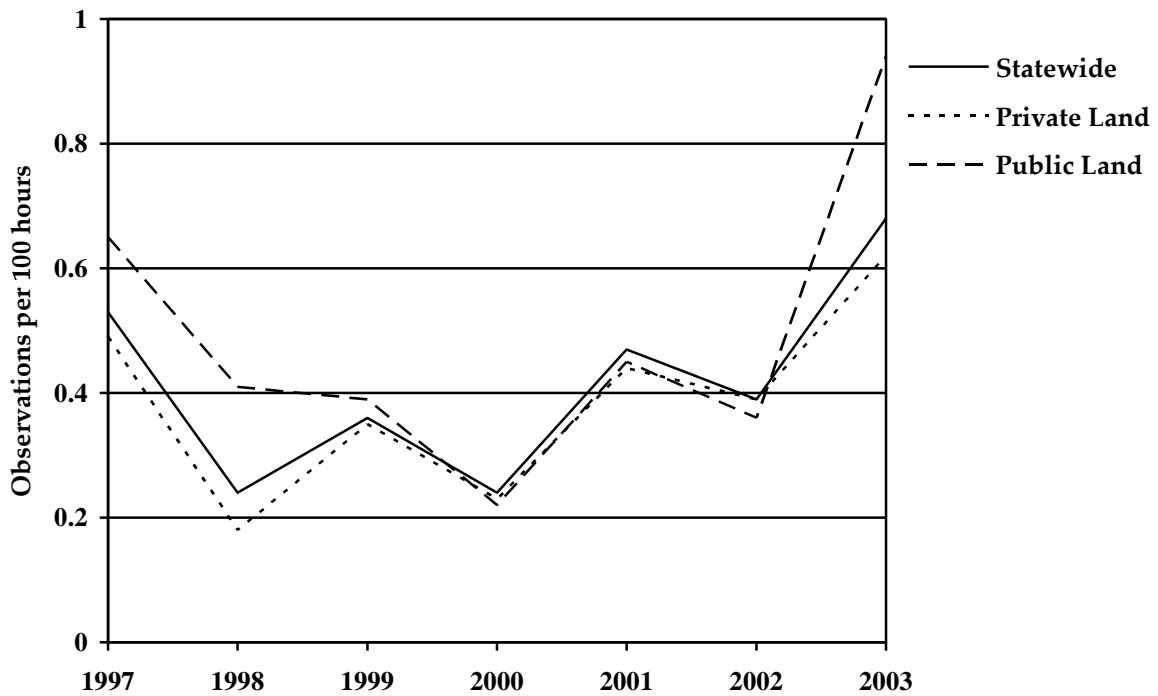


Figure 17. Black bears observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

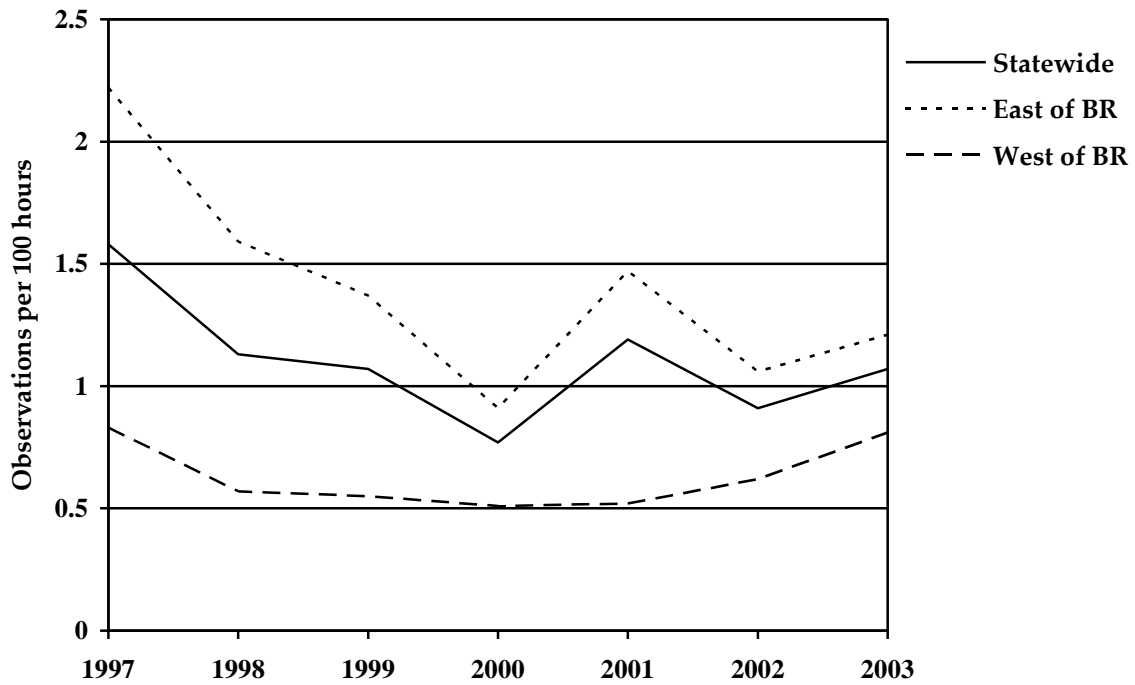


Figure 18. Red foxes observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

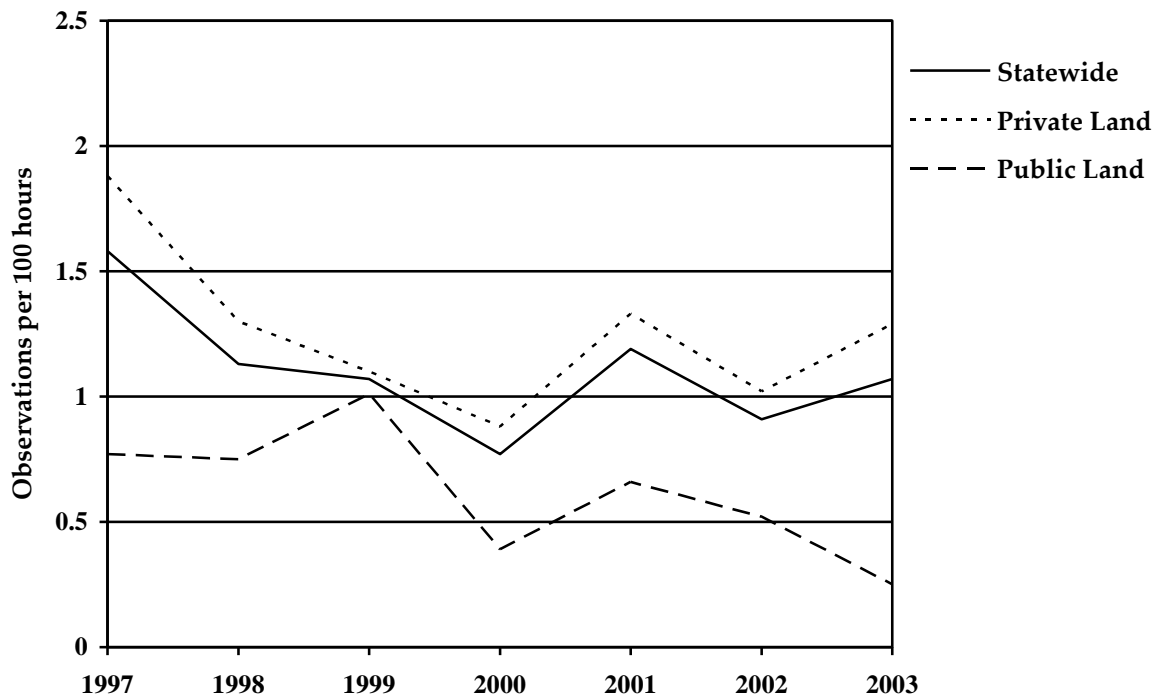


Figure 19. Red foxes observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

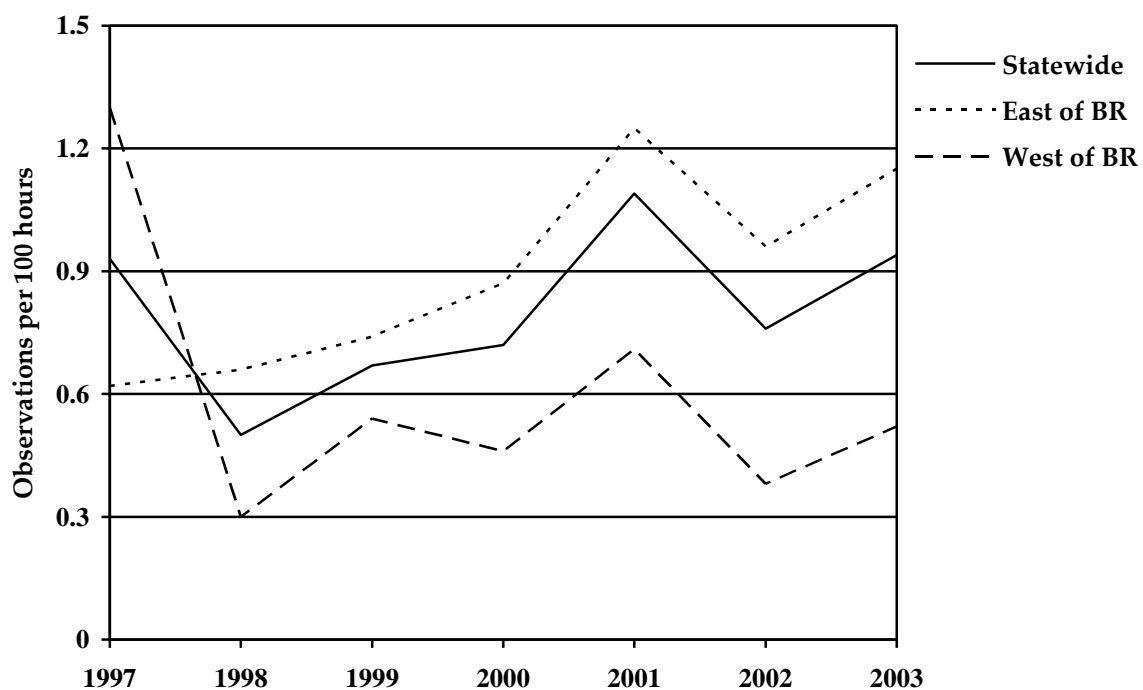


Figure 20. Gray foxes observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

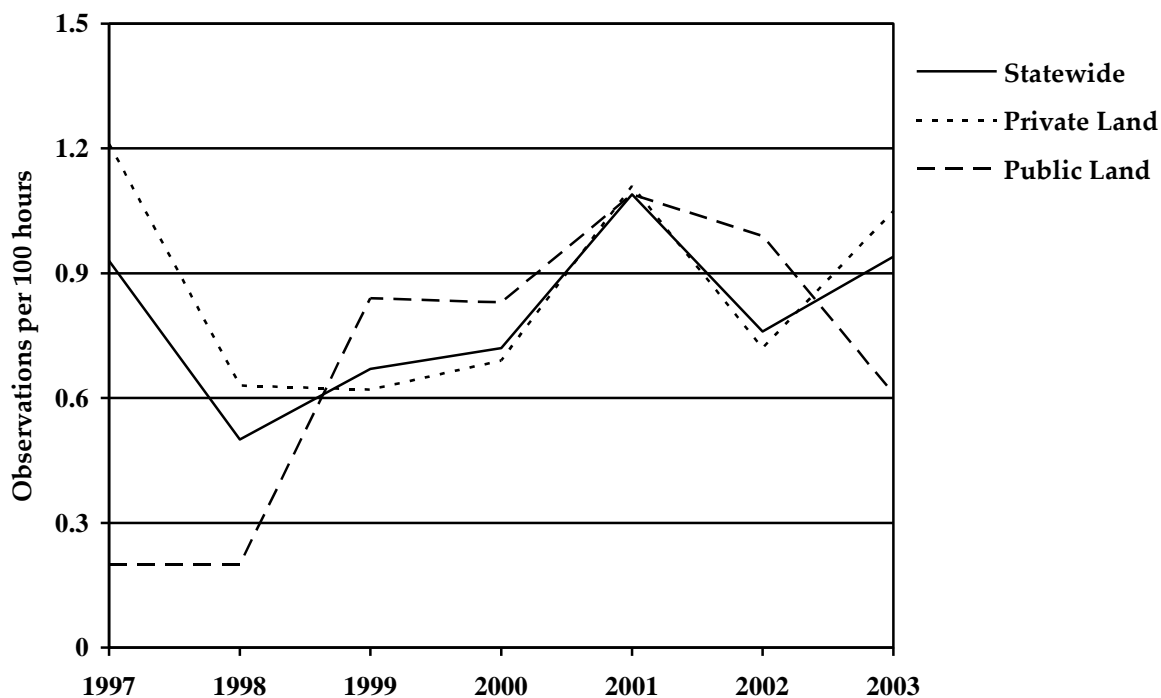


Figure 21. Gray foxes observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

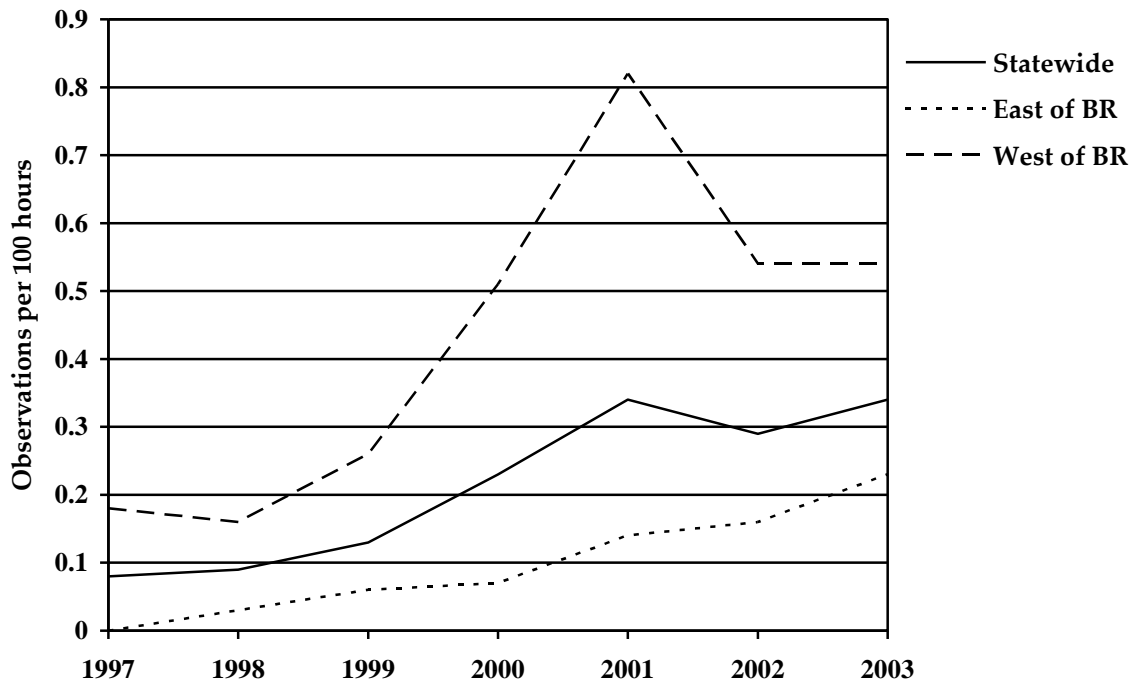


Figure 22. Coyotes observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

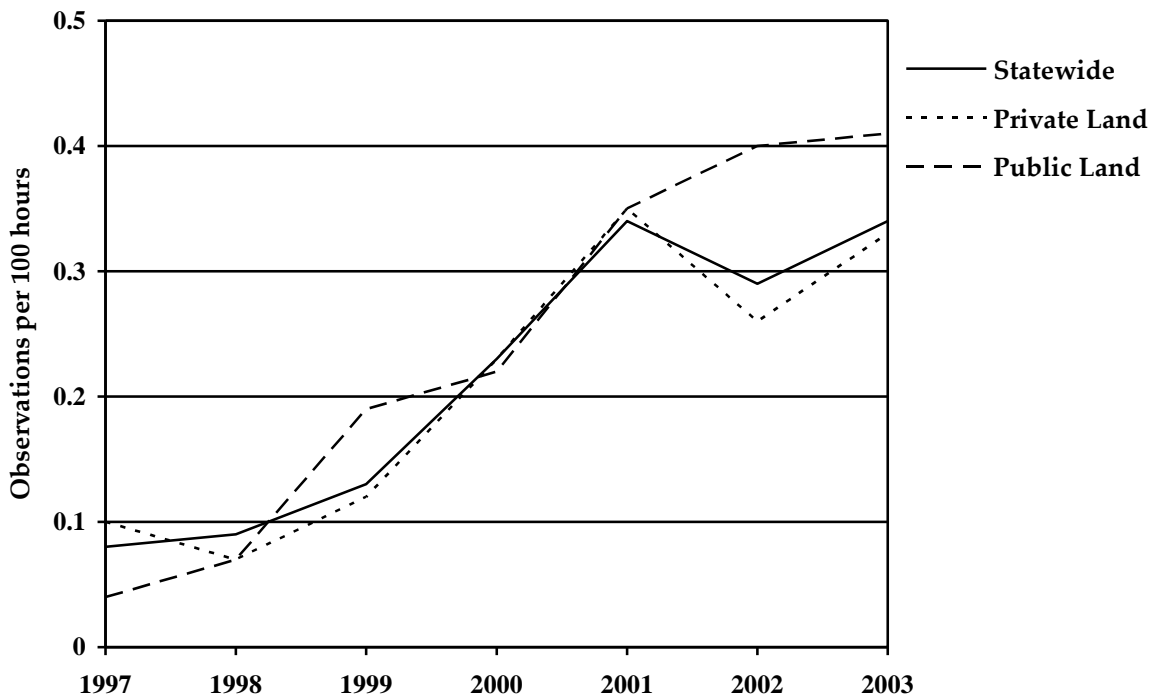


Figure 23. Coyotes observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

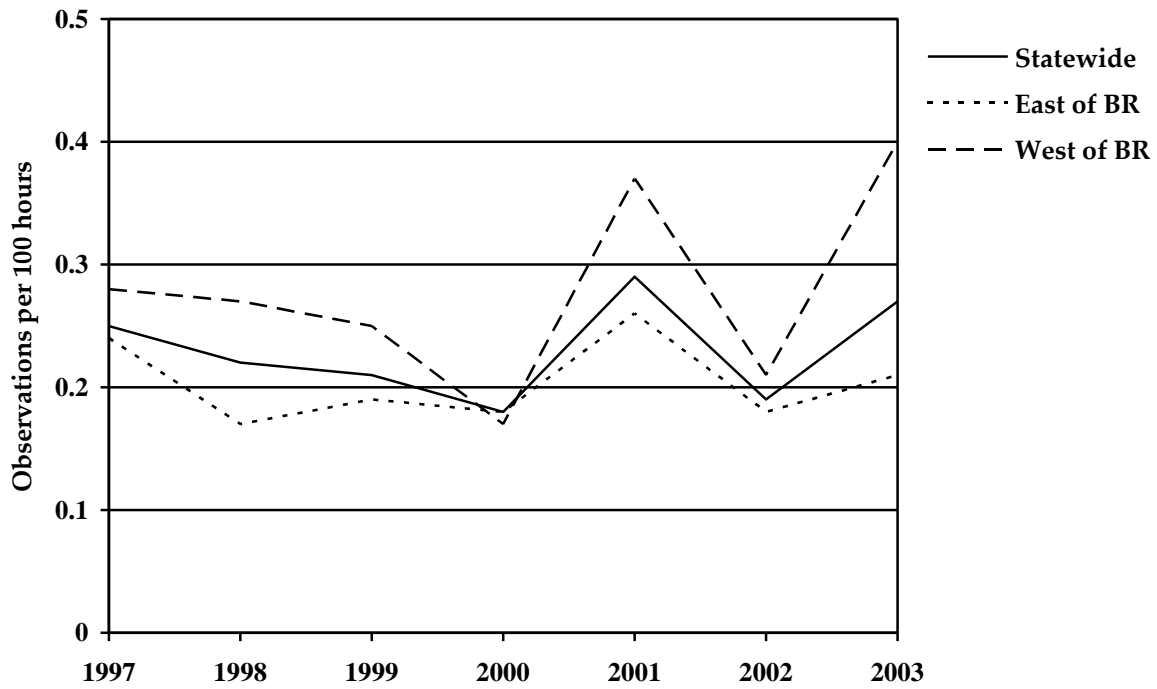


Figure 24. Bobcats observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

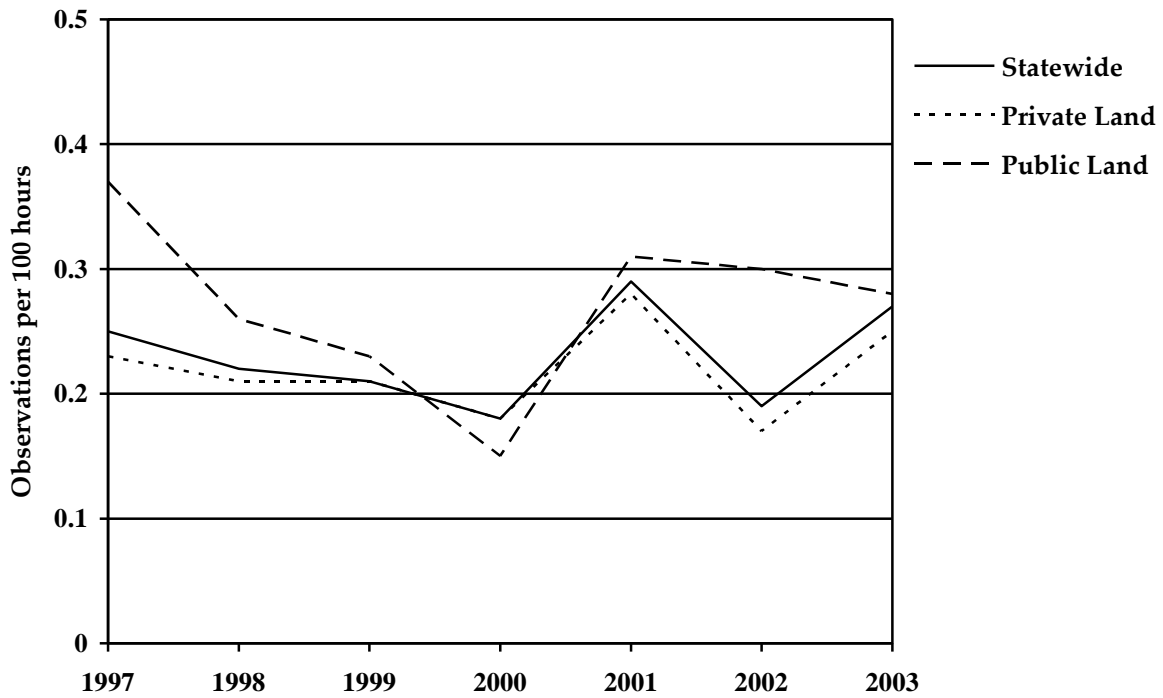


Figure 25. Bobcats observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

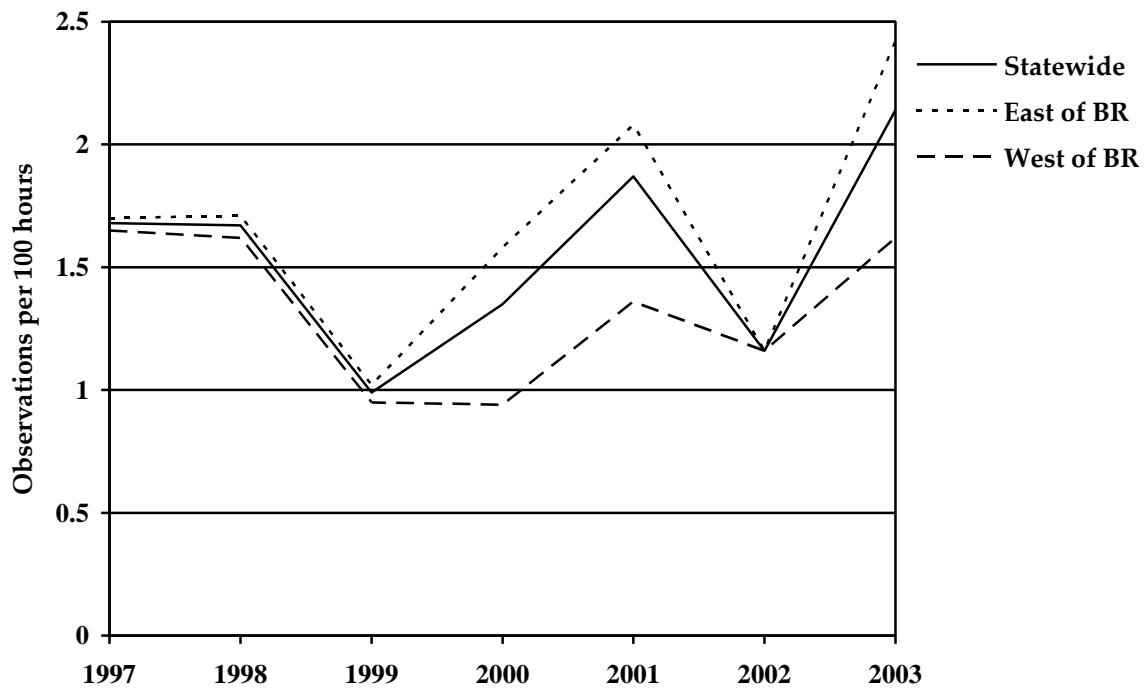


Figure 26. Raccoons observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

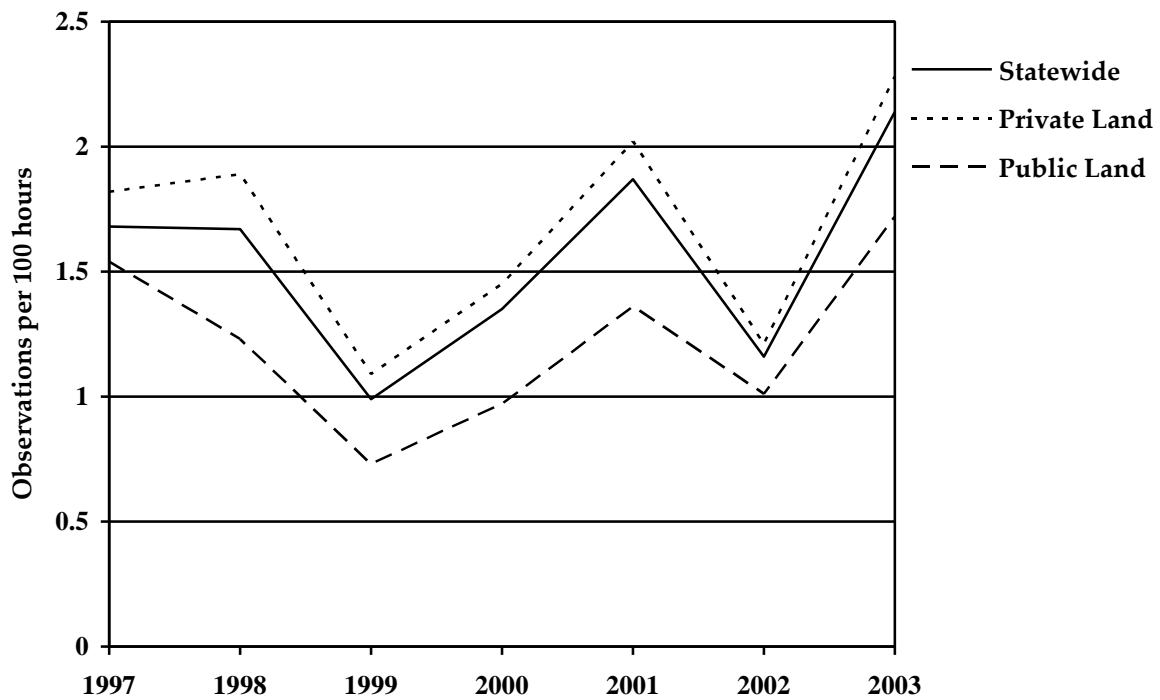


Figure 27. Raccoons observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

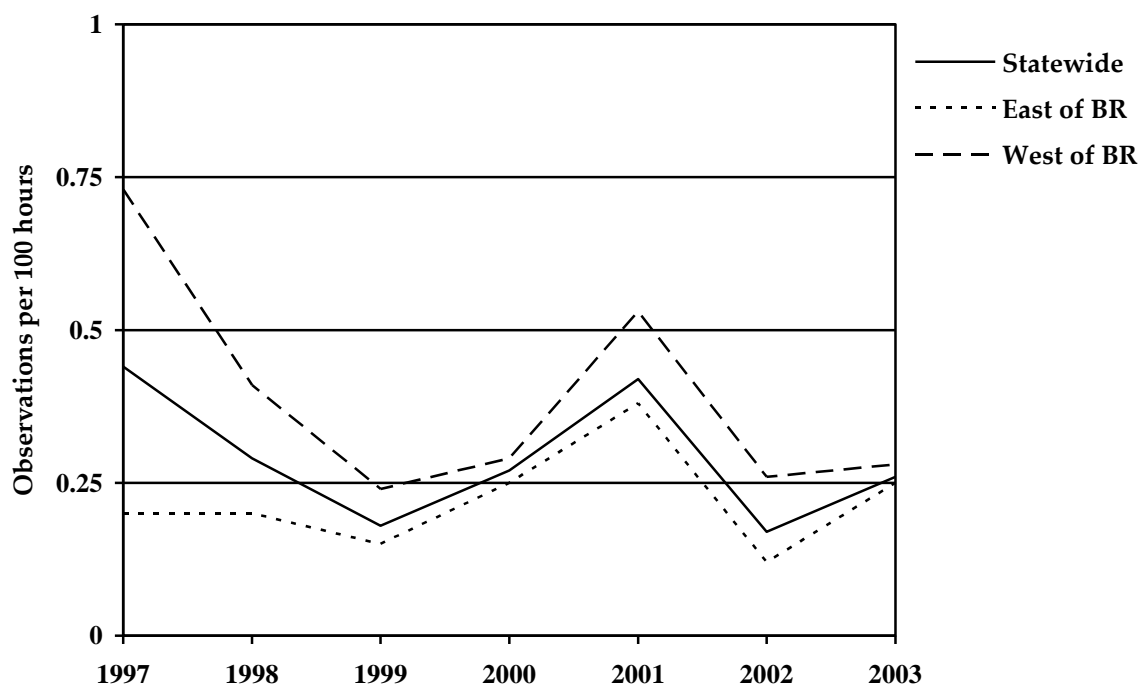


Figure 28. Opossums observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

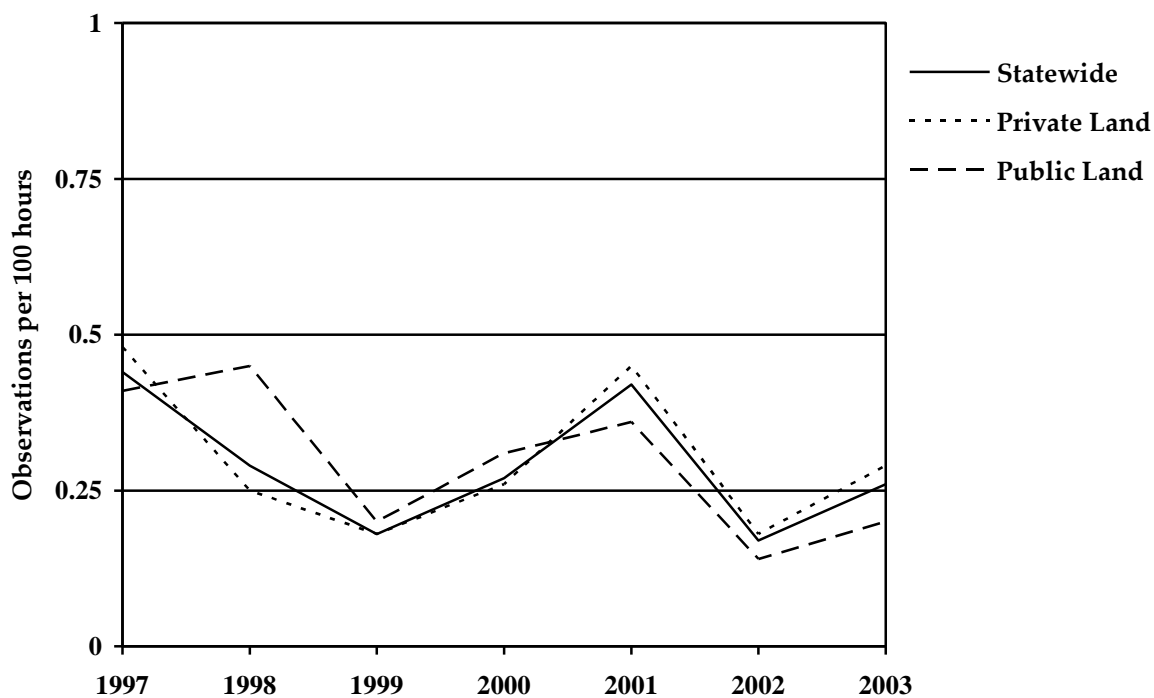


Figure 29. Opossums observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

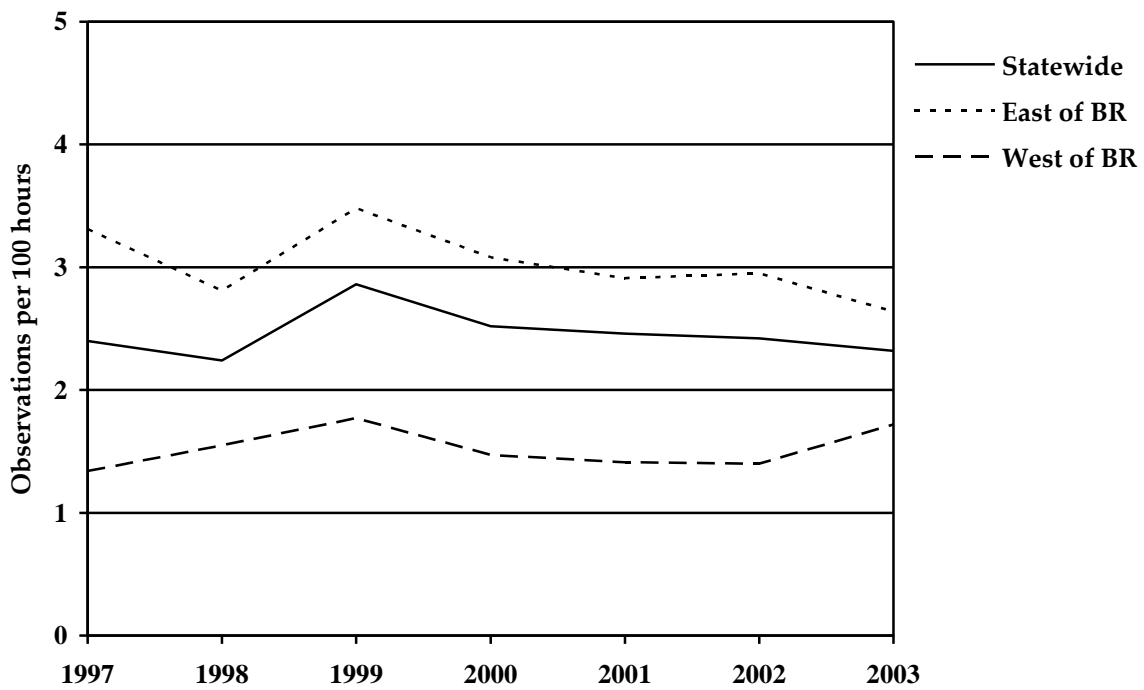


Figure 30. Dogs observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

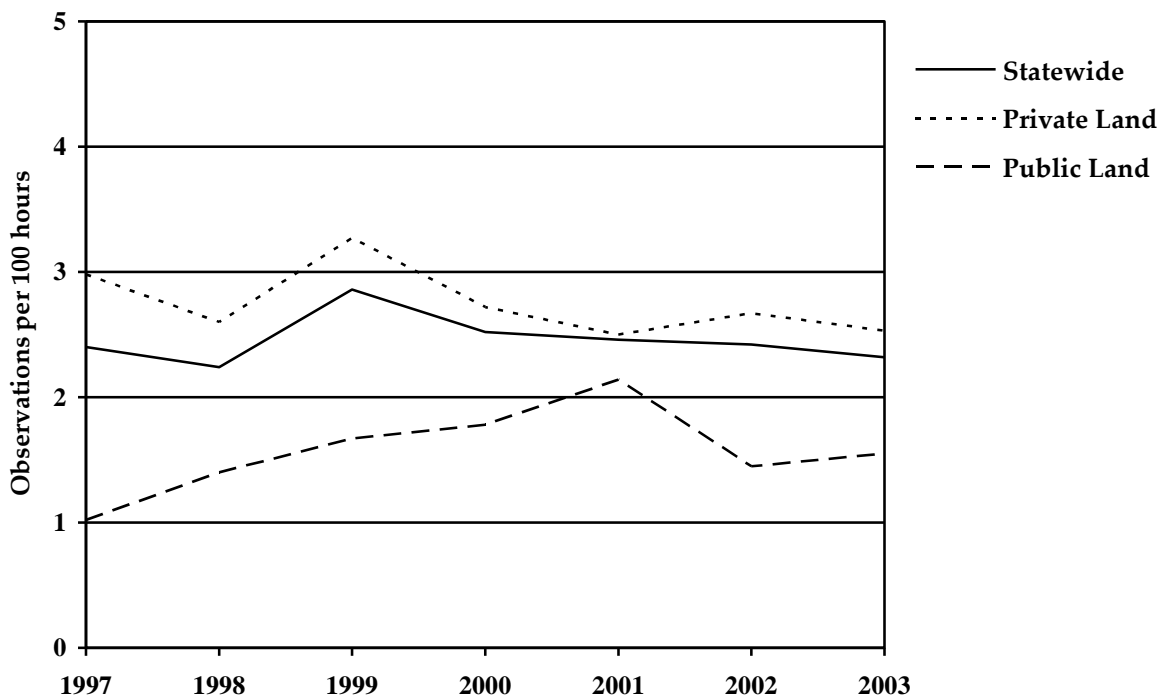


Figure 31. Dogs observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

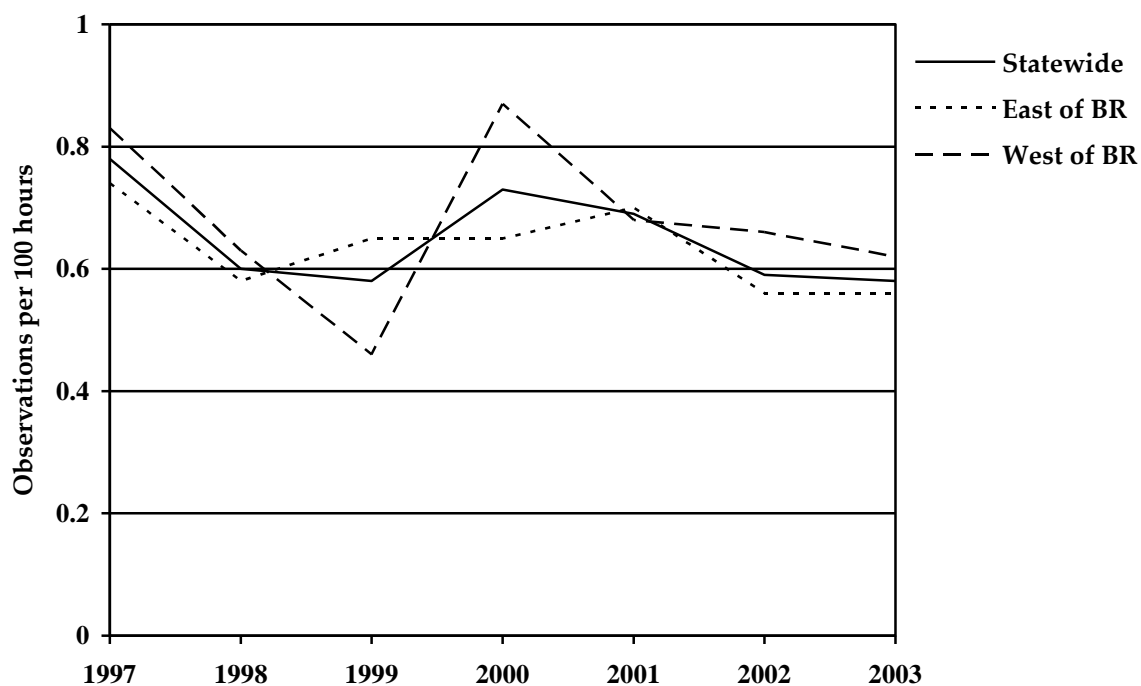


Figure 32. House cats observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

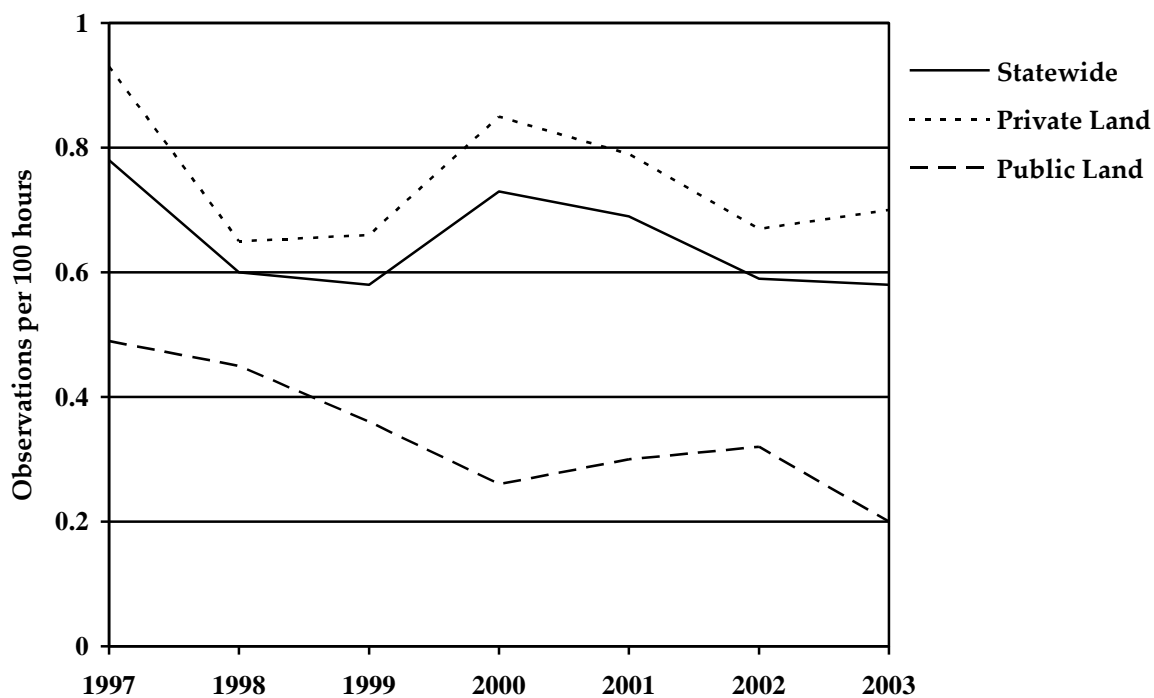


Figure 33. House cats observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

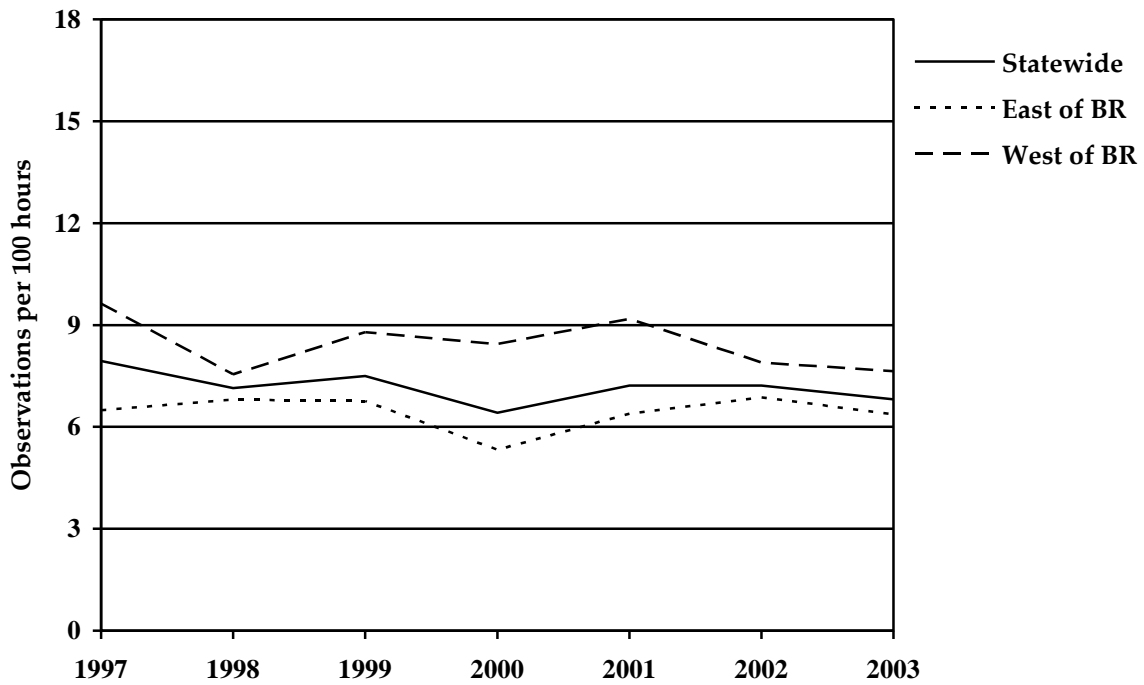


Figure 34. Hunters observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 east and west of the Blue Ridge Mountains and statewide in Virginia.

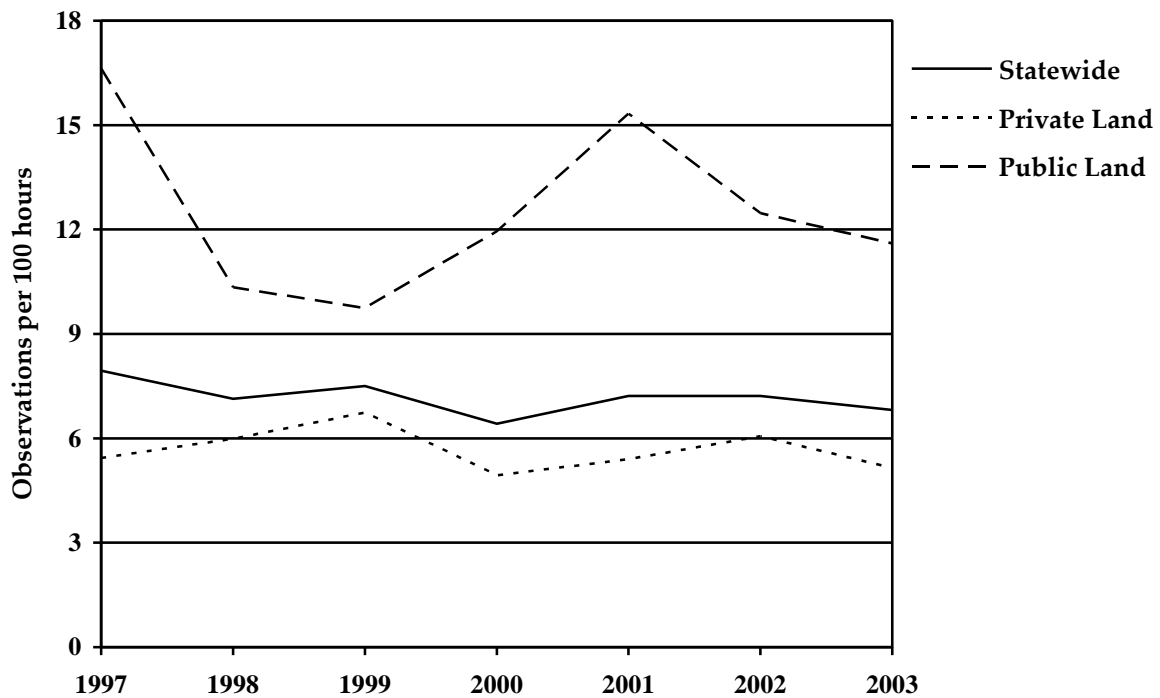


Figure 35. Hunters observed (per 100 hours of hunting) by cooperating early archery hunters from 1997-2003 by land ownership and statewide in Virginia.

Virginia Department of Game and Inland Fisheries

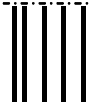
Name: _____
Address: _____
City and Zip Code: _____

Temperature: 1) <40° F 2) 40-70° F 3) >70° F

Appendix 1. Survey instrument for 2003-2004 Virginia Bowhunter Survey.

INSTRUCTIONS

1. If you wish to participate in next years survey, and do not wish to maintain your confidentiality, please fill in your name and address at the top of the form and in the return address box below.
2. Enter *number of hours* for each *date* you hunted **between Oct. 4 and Nov. 14** (early season) **only**.
3. Write in the *county* where you hunted. If you hunted in more than one county on one day, record different counties on different lines of the form.
4. Report whether or not you are hunting on *publicly owned land* (state or federal).
5. Enter the *number* of animals and other hunters you observed while hunting. Begin observations upon leaving your vehicle and end observations when you return to your vehicle.
6. If you saw a species *not listed* at the top of the chart, enter the *name* and *number* of animals in the "Other Animals" column near the right side of the form.
7. On the last four columns of the chart, record the *most conditions* and *average weather* conditions for the time period you hunted. Use the *numbers (codes)* given at the top right corner of the form.
8. *Fold* this form along the lines below so that our address shows, and *tape* it together.
9. Please *mail* this form to us by **January 1, 2004**. *No postage is needed*.



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VA DEPT OF GAME AND INLAND FISHERIES
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VERONA, VA 24482-9901



Name: _____
Address: _____
City/Town: _____

If you wish to continue to participate in the Virginia Bowhunter Survey, and do not wish to maintain any confidentiality, please enter your name and address in the return address box. Thank you.

RETURN ADDRESS (OPTIONAL).

DO YOU KNOW OF OTHER HUNTERS WHO WOULD LIKE TO PARTICIPATE IN THE BOWHUNTER SURVEY? IF SO, PLEASE ENTER THEIR NAMES AND ADDRESSES BELOW:

Name: _____
Address: _____
City/Town: _____

Name: _____
Address: _____
City/Town: _____

THANK YOU FOR PARTICIPATING!!



Appendix 3. Virginia counties hunted, hunts per county, and percentage of total state hunts per county by cooperating archery hunters 4 October to 14 November in Virginia.

County	No. Hunts	% of Hunts	County	No. Hunts	% of Hunts
Accomack	88	2.08	King William	89	2.10
Albemarle	57	1.35	Lancaster	34	0.80
Alleghany	9	0.21	Lee	41	0.97
Amelia	20	0.47	Loudoun	45	1.06
Amherst	124	2.93	Louisa	22	0.52
Appomattox	30	0.71	Lunenburg	4	0.09
Augusta	43	1.02	Madison	44	1.04
Bath	29	0.69	Mathews	4	0.09
Bedford	76	1.80	Mecklenburg	21	0.50
Bland	78	1.84	Middlesex	36	0.85
Botetourt	90	2.13	Montgomery	99	2.34
Brunswick	35	0.83	Nelson	39	0.92
Buchanan	2	0.05	New Kent	58	1.37
Buckingham	25	0.59	Northampton	48	1.13
Campbell	34	0.80	Northumberland	33	0.78
Caroline	82	1.94	Nottoway	53	1.25
Carroll	16	0.38	Orange	58	1.37
Charles City	41	0.97	Page	14	0.33
Charlotte	22	0.52	Patrick	63	1.49
Chesapeake	12	0.28	Pittsylvania	71	1.68
Chesterfield	21	0.50	Powhatan	30	0.71
Clarke	10	0.24	Prince Edward	24	0.57
Craig	16	0.38	Prince George	77	1.82
Culpeper	40	0.94	Prince William	40	0.94
Cumberland	27	0.64	Pulaski	13	0.31
Dickenson	92	2.17	Rappahannock	34	0.80
Dinwiddie	25	0.59	Richmond	16	0.38
Essex	79	1.87	Roanoke	39	0.92
Fairfax	98	2.32	Rockbridge	47	1.11
Fauquier	81	1.91	Rockingham	89	2.10
Floyd	54	1.28	Russell	14	0.33
Fluvanna	24	0.57	Scott	23	0.54
Franklin	38	0.90	Shenandoah	201	4.75
Frederick	9	0.21	Smyth	22	0.52
Giles	101	2.39	Southampton	160	3.78
Gloucester	28	0.66	Spotsylvania	17	0.40
Goochland	21	0.50	Stafford	13	0.31
Grayson	10	0.24	Suffolk	33	0.78
Greene	5	0.12	Surry	64	1.51
Greensville	37	0.87	Sussex	33	0.78
Halifax	27	0.64	Tazewell	41	0.97
Hanover	19	0.45	Virginia Beach	15	0.35
Henrico	36	0.85	Warren	4	0.09
Henry	78	1.84	N. News / Hampton	0	0.00
Highland	33	0.78	Washington	28	0.66
Isle of Wight	76	1.80	Westmoreland	37	0.87
James City	14	0.33	Wise	59	1.39
King & Queen	23	0.54	Wythe	69	1.63
King George	57	1.35	York	23	0.54

